SEP 30 1947

Electrical World

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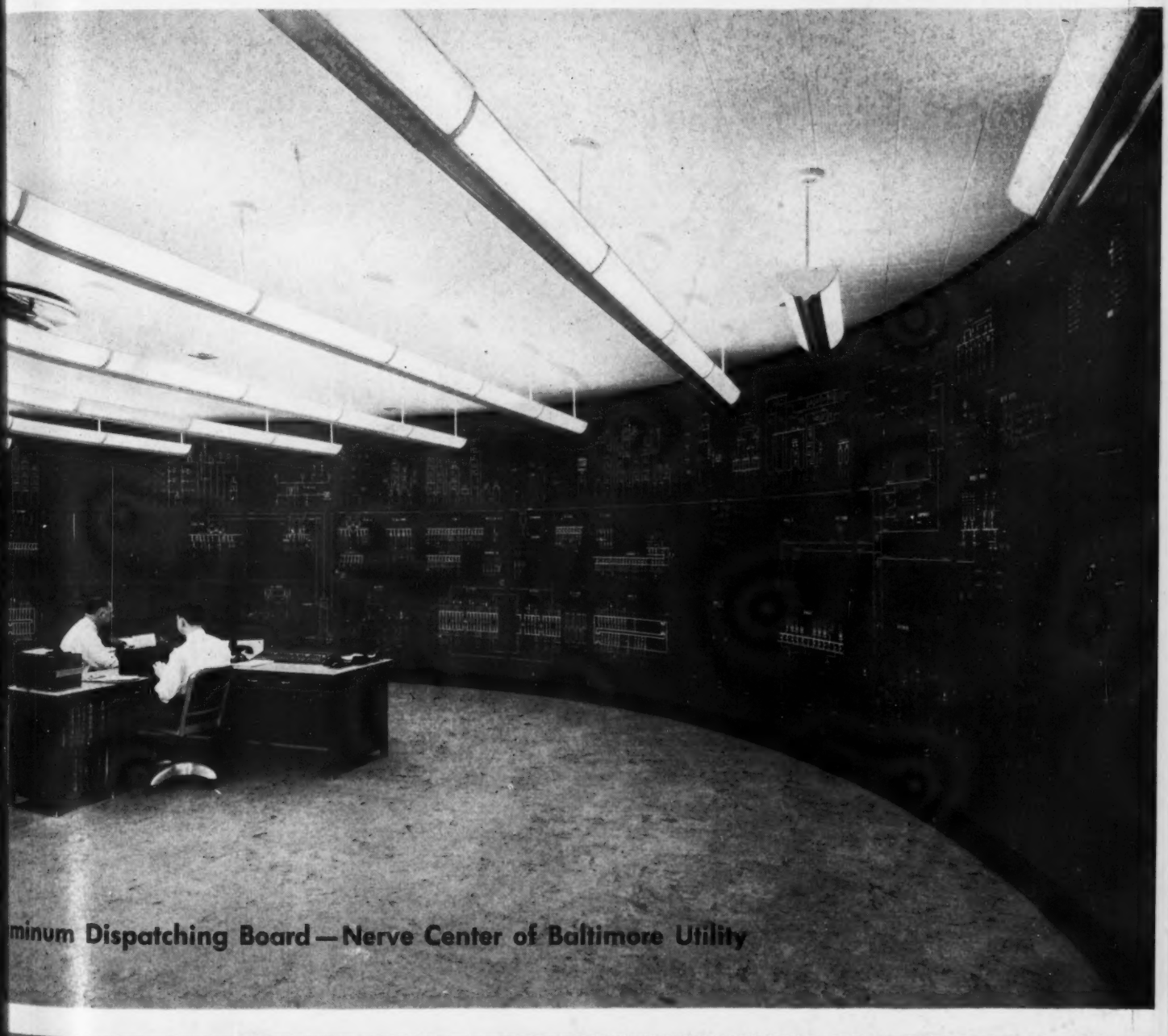


minum Dispatching Board—Nerve Center of Baltimore Utility

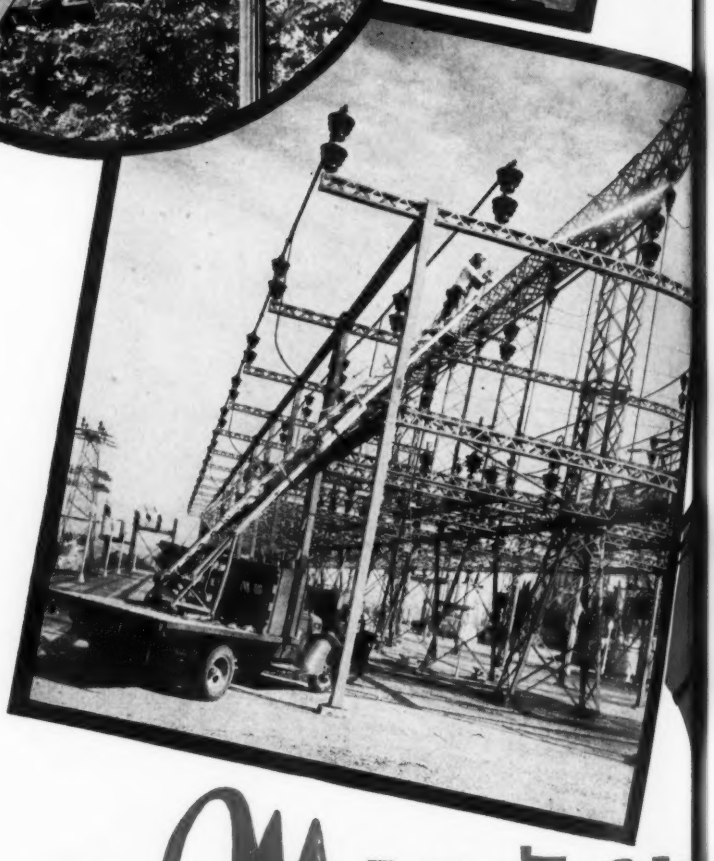
SEPTEMBER 27, 1947

Features

NEWS OF THE WEEK
Proof Test of 230-kv Fuse
Building Substations from Unit Assemblies
Diversity Factor in Economical Distribution Design

Use proves it the CHAMPION MAINTENANCE LADDER

Also special designs for **INDOOR** *use!*



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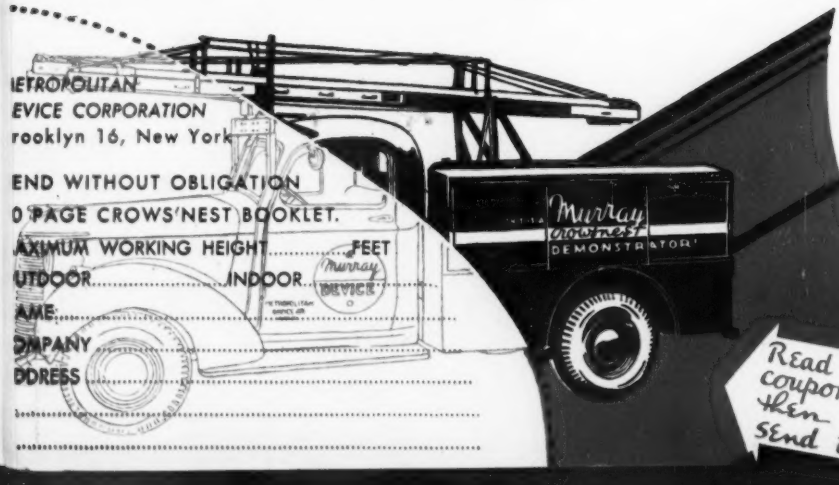

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September 27, 1947

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Modernized load dispatching facilities of Baltimore's Consolidated Gas Electric Light & Power Co include an aluminum board that is punched, painted, and diagrammed with colored paper tape. Board comprises sixteen 12 by 4-ft. panels, and is semi-circularly arranged on a 20-ft 6-in. radius. See page 54

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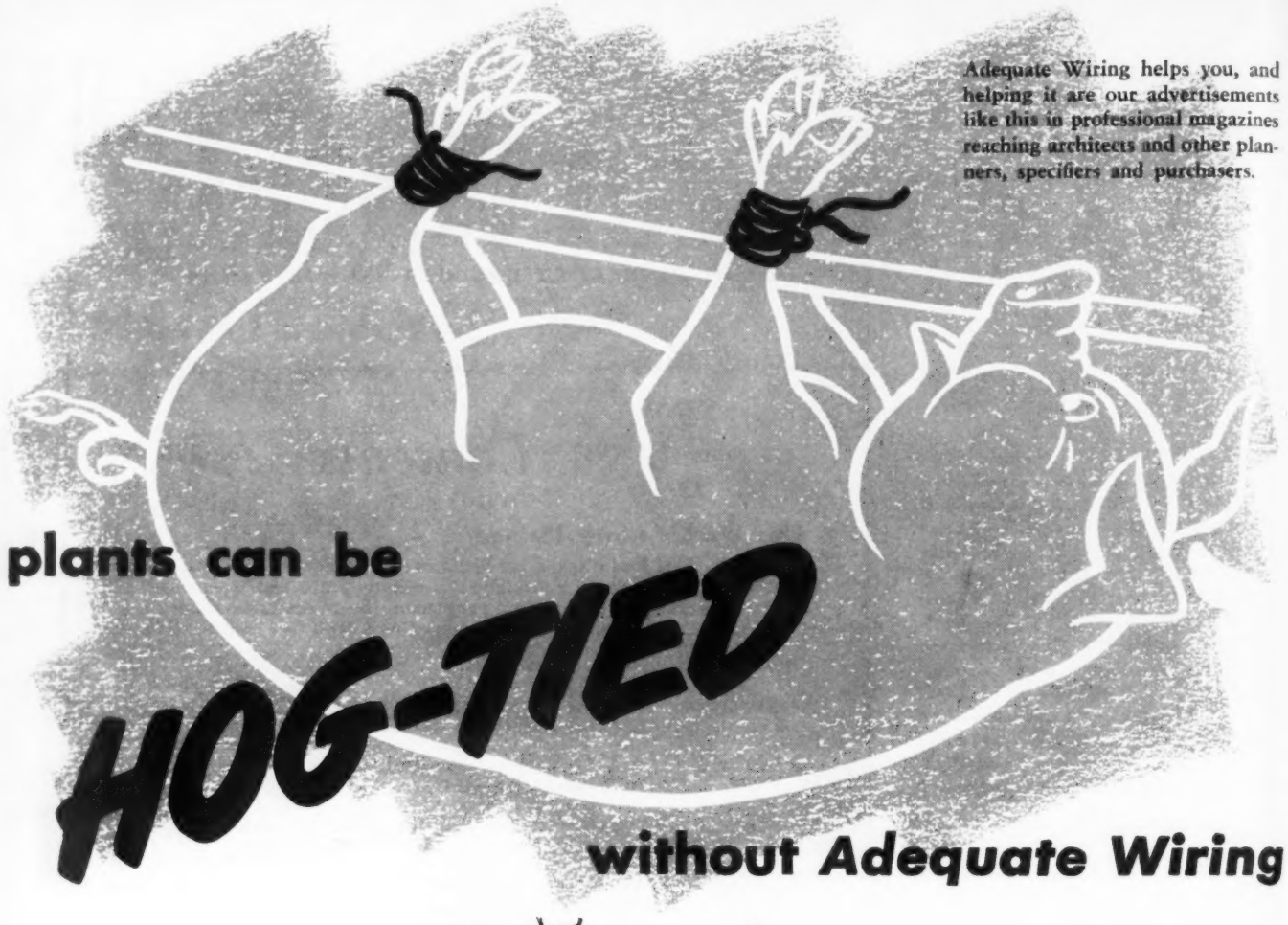

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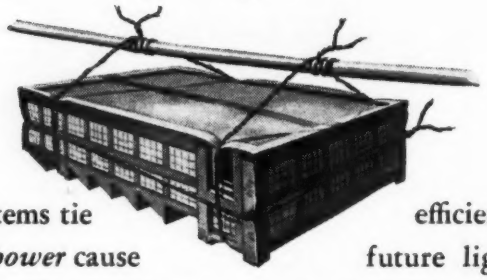

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Electrical World — Editorials

SEPTEMBER 27, 1947

Unanimity on Farm Electrification

COMING UP now is the second annual meeting of the National Farm Electrification Conference. This second meeting will be held because the first one, last year, was a success. Attendance was large; discussion was lively. There will be a third meeting next year if the second repeats the success of the first. And there will be a fourth and a fifth, a continuing series, on the same terms.

Last year the Conference was a new thing. Manufacturers, farm organizations, educational institutions, government agencies, power companies, professional societies, and others interested, had representatives at the first meeting more or less to find out what the Conference amounted to.

They found that, principally, it amounted to what was furnished by their own numerous attendance. This was its proof of the real need for a common ground on which the many minds and diverse interests concerned with farm electrification can meet and work towards coordination of their activities.

When the Conference was started in 1946, the Rural Electrification Administration was invited to participate. It refused. Its spokesmen said that the new organization was dominated by the "power trust" because the Edison Electric Institute belonged to it. More than that, it was rumored that the beneficiaries of REA loans were warned to have nothing to do with the Conference, to stay away from it. Despite all this, there were more than just a few representatives of rural electric cooperatives at the first meeting.

Since then there has been a change. REA is not now included in the list of Conference sponsors. But Claude R. Wickard, REA administrator, is a featured speaker on the program of the second meeting. Names of REA men appear on the several discussion panels. This change in REA attitude is most welcome. It adds strength to the Conference and does much to assure its continuance as a going concern. We hope that the participation of REA men in the coming meeting is the precursor to REA's joining the Conference and taking an active part in its work.

We hope this because the task of electrifying the farms of America is a bigger thing than those who do it. Whatever may be the differences between those working on the job, they must all agree that it has to be done. To get the job done is the single and only objective of the National Farm Electrification Conference. In the pursuit of that objective, there is no place for concern for one manufacturer's product as against the product of another. So also, it makes no difference to the Conference whether electricity is furnished to the farmer by a cooperative or by a power company. The purpose is to see that the farmer has the means and the know-how to use electricity. Since both REA and the power companies have that purpose, it is just common sense that they should work together towards it.

Now REA has turned from antagonism towards the Conference to "de facto", if not "de jure", participation in it. On their part, the power companies should see this change as reason for even greater support of the Conference. We hope to see evidence of this in an even more successful meeting in Indianapolis than was the first in Chicago last year.

★ ★ NEWS OF THE

U. S. Aid Needed by Europe to Restore Power Systems

Marshall Plan Places Requirements for 16 Countries and Western Germany at $250,000,000 for Next 4 Years—Raw Materials and Machinery to Be Sent Wherever Possible

SIXTEEN European countries and western Germany will require $250,000,000 over the next four years to restore and modernize their power systems. Most of this aid, in capital equipment and cash, probably will have to come from the United States.

These estimates were contained in details of the report on the so-called Marshall plan requirements of Europe as presented to the United States this week by the Committee of European Economic Cooperation. Electrical equipment requirements represented a comparatively small proportion of the total estimated needs, evaluated at some $22,440,000,000.

The European Committee proposed that a portion of the over-all needs might be obtained from other American nations or through financing by the International Bank and private credit sources. But the electric power plant requirements almost certainly must be met by the United States.

Considerable electric equipment will be needed during the next few years, it was reported. Europe's manufacturing capacity and production of electric generating plant will not be sufficient until at least 1949-50 to meet even normal annual requirements. Meanwhile, in order to carry out the rest of the Marshall plan recovery program, Europe must make substantial additions to its power plant. It is planned to expand total energy output by nearly 70 billion kwhr, "or 40 percent above 1947," and to increase generating capacity by 25 million kw, "two-thirds above pre-war."

European manufacturers will be able to produce increasing amounts of the annual equipment requirements for this program, it is estimated. But the deficit, to be made up by United States assistance, is calculated as amounting to $100,000,000 in 1948, $75,000,000 in 1949, $50,000,000 in 1950, and $25,000,000 in 1951.

It is reported that the European Committee has recommended that much of this aid take the form of materials other than finished power equipment. This group is said to feel that the "most effective" assistance would be afforded by supplies of (1) selected raw materials, (2) items of specific equipment which cannot be produced at present by European manufacturers, and (3) other equipment, such as machine tools for Europe's manufacturing plants and heavy machinery for construction of hydroelectric projects.

While details of the construction programs of each of the Marshall plan countries has not been revealed, they will fit into a general pattern. Some probable features of the program are:

1. Extensive exploitation of hydroelectric potentialities, as a step to conserve Europe's limited coal supplies.

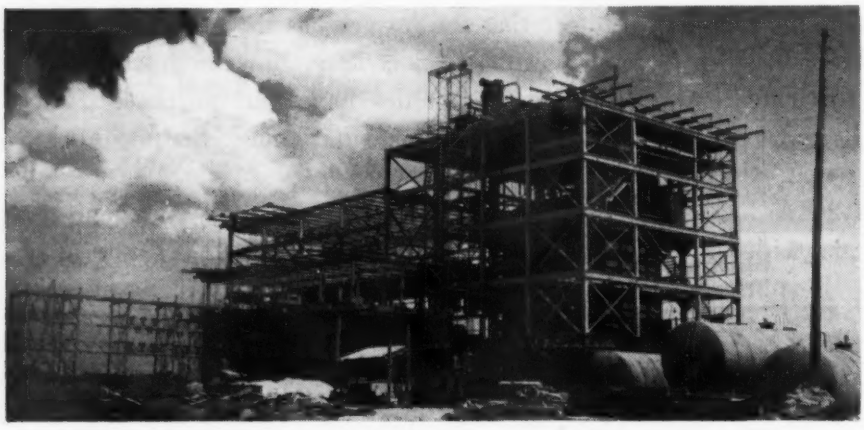
2. Construction of diesel-driven generating units (especially in the United Kingdom) and conversion of coal-fired boilers to oil use (being pushed in France). This also is a coal-conservation move.

3. Development of prime movers which can use efficiently the "brown coal" that is comparatively abundant in Germany.

Except in connection with hydro development, Europe will not need any great amount of transmission line construction. Prior to the war interchanges of power between different countries were inconsequential. Only Austria and Switzerland, which had abundant water power resources, exported substantial proportions—about 20 percent and 10 percent, respectively—of their total energy production. Elsewhere, emphasis undoubtedly will be put on expansion of existing fuel-burning plants and extensions of distribution lines.

Most other nations had adequate generating capacity and reserve for their own load demands. But the war abruptly terminated normal expansion of this plant. In 1945, total generating capacity of the Marshall plan countries was at approximately the 1938 level. Though approximately 2,351 Mw of generating capacity was added in 1945-46, this consisted largely of replacement or repair of equipment worn out or wrecked during the war.

Countries which participated in assembling the Marshall plan report were Austria, Belgium, France, Italy, Luxembourg, Netherlands, Switzerland, Denmark, Greece, Ireland, Iceland, Norway, Portugal, United Kingdom, Sweden, and Turkey.



BRICKWORK rises at Plant Hagood of the South Carolina Power Co at Charleston. A 22-500-kw unit will be installed. Three others are to follow

AEC's Atomic Patent Practice Endorsed by Advisory Panel

Patents for Making of Fissionable Material or Atomic Weapons Cannot Be Issued—Old Ones Are Cancelled—AEC May Requisition Any Discoveries in Non-Military Field

THE PATENT POLICY of the Atomic Energy Act and the patent practice of the Atomic Energy Commission got a thoroughgoing endorsement this week from AEC's patent advisory panel.

The panel, appointed to survey the patent procedures which AEC inherited from the Manhattan District, was made up of former Patent Commissioner Casper Ooms; William H. Davis, chairman of the Commerce Department's patent survey committee; John A. Dienner, former president of the American Patent Law Association; and Hector M. Holmes, Boston attorney. They made their first report to AEC this week.

Patent policy in atomic matters has been controversial ever since the war ended. Over the protests of most industry, the Atomic Energy Act modifies and in part eliminates the patent system as to atomic matters. The panel, however, insists that this step was a natural consequence of the law's policy of putting atomic development—in its early stages at least—under complete government control.

Under the Act, patents are wiped out so far as concerns production of fissionable material or atomic weapons. Existing patents on devices useful solely for these purposes are cancelled. No new ones will be issued. Patents valid in other areas can have no effect in these fields.

As to non-military applications of atomic energy, the law is designed to prevent patents from having any restrictive effect. AEC may requisition any discovery or patent in this field. Alternatively, it may declare such a patent of public interest and require that it be licensed at a reasonable royalty to anyone whose work is approved by AEC.

To replace the incentive to invention normally provided by the patent system, the Act sets up a system of payment by the Commission. Anyone whose patent is wiped out by the Act or is requisitioned by AEC is entitled to just compensation from the Commission. And in future, anyone who makes a discovery in the area where patents are forbidden is to receive fair payment from AEC.

As a practical matter, the panel report shows, the cancellation of existing patents has not caused much trouble. The vast majority of the 2,300 or so atomic patents applied for or issued have been government owned. Only some 20 seem likely to result in valid claims.

Reason for this is that ever since the days when the atom project was handled by the Office of Scientific Research and Development, policy has been to keep the government in control. Neither OSRD, Manhattan District, nor AEC followed the normal military practice of permitting contractors to take patents on discoveries made in the course of government work.

Only a negligible number of atom inventions have yet been made by people not under government contract.

So thus far AEC hasn't had to deal with any rush of claims—just the few cancelled patents, plus a half-dozen or so valid-looking claims for awards based on new non-patentable discoveries. However, the patent panel recommends that the commission get set with a system of compensation boards.

The panel strongly recommends that the commission make the most sparing possible use of its power to compel licensing of patents on atomic applications—so as to avoid upsetting normal business practices. Instead, AEC should prefer its requisitioning power or, better yet, should arrange informal settlement of any disputes over use of patents.

WALTON SEYMOUR, who has joined the staff of Interior Secretary J. A. Krug as head of the department's new Program Division

•

Telluride Power to Spend $500,000 to Better Service

Telluride Power Co will spend more than $500,000 for extension of facilities in its south central Utah area in the immediate future, Paul P. Ashworth, general manager, has announced.

The project includes enlarging and extending the transmission and distribution systems, installation of automatic voltage and line sectionalizing equipment, and building of duplicate lines into major load centers.

Work is already under way on replacing small with larger conductors on 44-kv lines in several sections of the region. Construction was slated to start in mid-September on a new 34-mile heavy transmission trunk line from Richfield to Gunnison, looping into the new U. S. Gypsum Co plant at Sigurd. A supplementary 44-kv trunk line will be built from Santaquin to Nephi for auxiliary service from the Northwest Power Pool through the Utah Power & Light Co system.

A 10,000-kw, 44-kv automatic regulating transformer has been ordered for installation at Nephi to stabilize transmission voltage on the entire power network.

Contract Made for Joint Use of Power Facilities

Texas Co-op and Southwestern Bell Co Make 5-Year Agreement for Carrier Telephone System

The Rural Electrification Administration last week announced details of the first operating contract completed in accordance with the recent REA-American Telephone & Telegraph Co agreement for joint use of power and telephone facilities.

The new five-year contract was made by the Southwestern Bell Telephone Co and the REA-financed San Bernard Electric Cooperative, Inc, of Bellville, Tex. At least five other operating contracts were being reviewed by REA, with approval expected momentarily, at the time this was written.

San Bernard's contract with Southwestern Bell provides for carrier telephone operations in overlapping portions of the service areas of company and co-op. This territory includes the towns of Hempstead, Bellville, Sealy, Columbus, Eagle Lake, Halletsville and vicinity.

Though carrier telephone installations are expected to be limited to areas of low consumer density, the contract has attracted considerable interest since it is the first to effectuate the REA-AT&T agreement (ELECTRICAL WORLD, June 28, Page 13.)

Southwestern will own, but the co-op will install, telephone equipment including coupling assemblies, taps, and chokes on San Bernard's power poles. The company will install and maintain all other facilities necessary for telephone service.

Southwestern Bell will pay the co-op a "rental" fee of $1 annually for each of the power poles it uses for telephone service. The co-op will make the following charges for servicing equipment:

Equipment	Installation	Annual Payment for Power
Coupling assembly	$25.00	....
Isolating choke	25.00	$2.00
Tap or transmission choke	16.00	.10

For removing any of the three above items, the charge will be $15.

A flat rate of $13 for maintenance, including replacement, also will be paid by the company.

At the insistence of REA, the original contract was revised to permit review of the service charges during January of each year at the request of either party. The contract provides that the co-op shall not ask for such review without approval by REA. Purpose of such a study would be to make the charges "conform to the actual cost" incurred by the co-op

At the end of the five-year contract period, the agreement will be subject to termination by either party upon a year's notice.

Get Them Young, Train Them Early

A plan by which summer job scholarships will be offered to outstanding sophomore and junior students in engineering at Oregon State College has been worked out between the college and the Portland General Electric Co. The chief objective of the company in sponsorship of the scholarships, James H. Polhemus, PGE president, said, is to attract electrical engineering students into the power field.

•

Arizona Power Authority Ousts Aldrich as Director

Controversy over disposition in Arizona of Colorado River power has resulted in the removal of Kenneth B. Aldrich as director of the Arizona Power Authority.

Michael J. Dougherty, chairman, announced recently that the Authority and the Bureau of Reclamation had worked out a tentative cooperative agreement under which the Bureau will build the main transmission lines of a state power grid. The Authority will then build the lower tension lines to reach specific markets.

Aldrich had maintained that the state should build the whole system under a program involving $30,000,000 in bonds. The Authority had such a program before it knew the Bureau could be interested in building the major transmission circuits.

Aldrich held that it had always been assumed that it was the intent of the Arizona legislature in passing the Power Authority Act that the Authority should establish a transmission system and particularly make power available to remote areas of the state and that the resolution never had been modified.

He maintained that the federal government does not construct the "backbone" lines at federal expense, but merely advances funds to the Bureau of Reclamation which must be repaid the same as any other bond or loan.

Aldrich said that if the Authority uses lines constructed by the Reclamation Bureau it must pay for their use on a basis similar to that which would exist if the Authority were to issue bonds and construct the lines itself.

Northwest Pool Discusses Ways of Beating Shortage

Possibility of an emergency during the winter power peak which might result in a critical power shortage in Oregon and Washington has caused the Northwest Power Pool, voluntary coordinating organization of operating electric utilities, to consider means of combatting such a situation.

Meeting at Portland, members of the pool took an optimistic view of conditions. At the same time they discussed remedies that might be applied should the flow of the Columbia River and its tributaries be lower than is now forecast. In such an event it was realized that overloaded generators in the hydroelectric plants at Grand Coulee or Bonneville might conceivably break down, causing a really critical situation.

Pool executives and engineers were advised that, with estimates of a winter power load in excess of 2,000,000 kw a month at peak periods, full operation of all available generating capacity, both hydro and steam, will be required.

A. L. Darland, assistant project engineer at Grand Coulee, said six 108,000-kw generators have been operating at an average load of 130,000 kw. Installation of a seventh generator, rated at 120 000 kw, is scheduled for completion November 1.

Utilities operators admitted that, even without a generator breakdown, it may be a tight squeeze to get through the winter with no reserve supply of power. They are short 600,000 bbl of oil needed to keep their steam plants going.

Suggestions on means of curtailing consumption should the shortage become serious included blackout of commercial signs and store windows, appeals to householders to conserve power during peak use period, and shifting of industrial loads off of peak. Largest consumers of electricity in the area are aluminum plants, and it was suggested that production in this industry might be curtailed if necessary.

Recent rains in Montana and along the upper reaches of the Columbia have increased the flow in rivers that generate most of the Northwest's power, dissipating to a great extent earlier fears of low water during the winter.

•

Utility Leases Army Unit

Generating facilities at Fort Huachuca, Ariz., inactivated army base, have been leased to the Nogales Citizens' Utility Co and will be used to supply power to the border city. The generator is capable of about 1,800 kw.

G. C. TENNEY

R. H. FLYNN

L. H. HILL

A. E. KNOWLTON

S. A. TUCKER

D. T. BRAYMER

Tenney Named Editor; Flynn, Publisher, as Hill Resigns From Electrical World

Ralph H. Flynn has been named publisher and George C. Tenney acting editor of ELECTRICAL WORLD to succeed Lee H. Hill, who has resigned as of October 1 to return to industry.

Tenney will retain his responsibilities as vice-president of McGraw-Hill Publishing Co and publisher-editor of *Electrical West*. He joined the latter publication in 1920 upon graduation from University of California and has been editor since 1930. A past-president and for 17 years a director of the Pacific Coast Electrical Association, he has been chairman of the San Francisco section of AIEE. Currently he is vice-president of San Francisco's Chamber of Commerce.

Flynn will be publisher of McGraw-Hill's electrical unit, which consists of *Electrical Construction & Maintenance* and *Electrical Wholesaling* in addition to ELECTRICAL WORLD. He became a member of *Electrical West's* editorial staff in 1930, after graduation from University of Southern California, and subsequently left to join the sales department of Pacific Gas & Electric Co. Later he became advertising manager of the then San Joaquin Power & Light Corp. Returning to *Electrical West* in 1935 as eastern manager, he was given added duties as district manager of *Electrical Merchandising* and *Electronics* in 1937. He has been assistant publisher of the unit since April 1.

Hill spent 20 years with American Brown-Boveri, Westinghouse Electric Corp, and Allis-Chalmers Manufacturing Co before coming to ELECTRICAL WORLD in 1945. He has a nationwide reputation as an authority on labor-management relations, and while at Allis-Chalmers organized and headed the industrial relations department as vice-president. Previously he had been assistant manager of that firm's electrical division and manager of the transformer division.

Other changes on the ELECTRICAL WORLD staff include the appointment of Stanley A. Tucker as managing editor to succeed Daniel T. Braymer, who becomes associate editor. Archer E. Knowlton has been advanced to senior associate editor.

Braymer, a graduate of Cornell, was in the operating department of New York State Gas & Electric Co before joining ELECTRICAL WORLD in 1935. Most of his editorial service has been in Chicago as western editor. Tucker was with Consolidated Edison Co of New York before joining the magazine *Power* in 1937. Following the war he traveled Europe for McGraw-Hill World News Bureau and came to ELECTRICAL WORLD in January, 1947.

Knowlton has been associate editor since 1930, coming to the publication from Yale University and Connecticut Public Utilities Commission.

•

60,000-Hp Unit Planned

Plans have been announced for installation of a 60,000-hp generator at the Bonnington Falls plant of Nelson, B. C., on the Kootenay River.

Smith Warns Regulatory Boards to Use Discretion

FPC Chairman Indicates Concern for Possible Future Applications by Utilities to Raise Power Rates

State and federal regulatory commissions were warned this week by Federal Power Commission Chairman Nelson Lee Smith to exercise sound "procedural discretion" in adjusting utility rates.

Speaking before the Public Utility Section of the American Bar Association at Cleveland, Smith twice cautioned his fellow regulators in terms which seemed to indicate concern for possible future cases involving rate increases rather than decreases. He did not, however, specifically mention any utility demands for increased rates.

At one point, he advised regulatory bodies not to "assume lightly their obligation to see to it that investors as well as customers are treated fairly." Commission discharge of this "dual responsibility" will receive careful scrutiny, "particularly during these days of cheap money and rising prices and costs," he added.

Commenting on FPC's record of rate reduction orders, Smith pointed out that the Commission's activities in this respect had been implemented by acceptance by the courts of the net investment rate base as a substitute for the old "fair value" concept. Rates of return on the new base have been set by FPC to range from 5 percent for low-risk hydroelectric properties to 6½ percent for some natural gas companies, he pointed out.

Rates of Return Must Vary

But rates of return must vary "from time to time and from company to company depending upon the attendant general and particular circumstances," Smith asserted.

"While purely economic considerations point to the desirability of rather frequent and sensitive adjustments of rates and returns reflecting changing conditions, as a practical matter it is necessary to recognize the existence of the so-called regulatory lag on swings both upward and downward. This lag may and should be reduced through prompt and intelligent action on the part of all concerned, but it is not likely to be eliminated entirely. Therefore, it is necessary that commissions in dealing with rates of return—as in reviewing budgets and estimates of operating expense—avoid undue emphasis upon short-term fluctuations as distinguished from long-run trends.

"Similarly, it is important for us all to keep in mind the fact that the consumer interest is not limited simply to the lowest rates that can possibly be secured; reasonably satisfactory service is equally important."

WHY FLORIDA has fewer power lines in service than it did a few weeks ago is indicated by this picture taken during the hurricane. Note the power pole either snapped at the base or else sloping from the perpendicular and the trees bending under the force of the wind. The scene is at Riviera Beach served by Florida Power & Light Co

•

Army Control at Hanford Ends; Shugg Is Manager

Military control at the Hanford Engineer Works, Richland, Wash., ended this month with the replacement of Lt Col Frederick J. Clarke by Clareton Shugg, formerly general manager for the Todd Shipyards Corp, New York. The change was in line with the Atomic Energy Commission's policy to place civilians in charge of all its operations, David E. Lilienthal, chairman, said.

Shugg, born in Boston, was graduated from the Naval Academy in 1920 and resigned from the Navy in 1929. He has been factory and production manager for the Sprague Electric Co and production director for the Cramp Shipbuilding Co.

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50-Year Franchises Granted

The New York Power & Light Corp has received permission from the New York Public Service Commission to exercise new electric and gas franchises in Hudson Falls. The franchisees, which will replace former ones, will run for 50 years.

Hurricane Damage Great; Other Utilities Send Help

The hurricane last week in Florida and the Gulf section of the Southeastern states reenacted the tragedy that has happened frequently in the past. Winds, ranging up to 120 miles, swept across the southern part of Florida, across the Gulf of Mexico, hit the coast of Mississippi, blew on to Louisiana, turned north, and died away. Behind they left miles and miles of transmission and distribution lines on the ground, thousands of poles snapped or down, and damages still unestimated in dollars.

As usual the stricken utilities were not left to fight their battles alone. Into the Florida area, Carolina Power & Light Co sent 60 men. Georgia Power Co sent five crews. Alabama Power Co and Birmingham Electric Co also sent trucks and crews.

At the other end of the Gulf, Houston Lighting & Power Co sent two trucks and about 35 men to New Orleans to assist the New Orleans Public Service Inc. Gulf States Utilities Co sent two crews from Beaumont, Tex., one from Port Arthur, Tex., and two from Lake Charles, La., to assist in repairing damage to the Gulf States system at Baton Rouge. Three of these crews were later sent to New Orleans to aid NOPSI.

In all sections electrical contractors aided with men and materials and manufacturers made available all equipment in warehouses and rushed other supplies to the stricken area.

Indianans Favor Cooperation Over Government Planning

Indiana Electric Association Told that Capacity Reserves Will Be Less Than 7 Percent during Winter Peak—Wilkes Pins Hopes on Congress in Controversy with Public Power

COOPERATION at grass root levels will better solve the industry's problems than any foreseeable plan or program originating from Washington. That was the basic fundamental thought that permeated all meetings of the Indiana Electric Association last week at French Lick. More than 400 utility executives and engineers were present.

E. F. Fields, vice-president, Cincinnati Gas & Electric Co, in his paper on the coordination of power supply stated that facts now available refute any suggestion of a widespread power shortage of serious proportions. Estimates of capacity and load for the coming winter indicate reserves will be between 6 and 7 percent of an estimated 51,800,000-kw capacity.

He stated that commitments for new capacity aggregate 12,000,000 kw. These are expected to be installed before 1951. Capacity additions, Fields indicated, would be at a greater rate than load growth in 1948 and 1949. However, he did not feel that any substantial increase in reserves would be available before the end of 1949.

Peak Tops Plant Capacity

Peak load in the Indiana area in 1946 was given as 2,073,000 kw with a generating capacity of 1,996,000 kw. Firm purchases of power from outside utilities brought capability for that period up to 2,289,000 kw. This provided reserve of 216,000 kw. or 9.4 percent in 1946.

The December, 1947, peak for the same area is expected to increase by 12.1 percent, or 255,000 kw, the reserves decrease to about 7.5 percent. Reserves at the end of 1949, if load developments follow the historical pattern, and they may or may not, should be about 17 percent.

In describing the public power controversy in the Southwest, Frank Wilkes, president, Southwestern Gas & Electric Co, stated, "We have found Congress very anxious to hear our story. In Congress rests our only hope, and we must continue to make appearances there and tell our story over and over again. We are hopeful that a new public power policy will be established in 1948 which will protect our industry against further inroads by the public power trust."

Wilkes stated that the pattern of the various acts against private utilities and the attitude of certain agencies in Washington indicated very clearly that a master plan was being followed.

He indicated that Edwin Vennard, vice-president of Middlewest Service Co, Chicago, found the blueprints of this master plan in a book entitled "Socialism of Our Times." This was reported to have been edited by Edward W. Laider and Norman Thomas and published in June, 1929. On Page 83 of that book, H. S. Raushenbusch, a Socialist, laid out the blueprint of this so-called public power trust.

Raushenbusch was reported to have published two articles in the *New Leader*, on March 5 and 12, 1927, in which he stated that "the process of socialization in this country will have to be a boring-from-within process, placing young men properly educated in Socialistic principles in bureaus in Washington. This would enable them, through propaganda, to gradually destroy the reputations built up by industry, and turn thinking toward government ownership."

Wilkes said that when Vennard searched for the whereabouts of Raushenbusch, he found him in the Department of Interior as head of its Power Planning Division. He added that Raushenbusch resigned under pressure on January 15, 1947.

In discussing economic trends as they affect collective bargaining, H. K. Breckenridge, vice-president, West Penn Power Co, stated, "In general, our industry has kept pace with the rise and wage levels in other industries and has been a leader in providing many of the other forms of employee benefits. Preliminary reports of wage increases made during the past twelve months in the electric utility industry indicate an average annual increase in payrolls of $279 per employee. The average hourly rate of our industry has increased more than 50 percent and average weekly earnings 56.4 percent. Compared to the average for all manufacturing industries since January, 1941, the average hourly rate of our industry is 12 percent and average earnings 15.4 percent higher.

In discussing the future, Breckenridge stated that our industry in the years immediately ahead should offer an exceptionally attractive field for young engineers. They can find a combination of stability of employment and opportunity for advancement on their jobs. We need to resell to the engineering schools the opportunities which do exist for young engineers, if we are to get a high quality personnel which will be needed for our engineering and management positions in the years immediately ahead.

An aggregate construction expenditure of approximately $5,000,000,000 for new plant capacity by the end of 1951 will be necessary to serve adequately the load of the future, Charles E. Oakes, president of the Edison Electric Institute, stated. He emphasized that if this program is completed within that given time, the plant account total will be increased nearly one-third and capitalization of the companies nearly 25 percent. As a result, he stated, it is obvious that yearly accruals for depreciation reserves must be increased.

They Mean No

A proposal that Valdosta, Ga., issue $800,000 in revenue certificates for acquisition of the local distribution system lost recently, 2,264 to 1,790. It was the second defeat at the polls for municipal ownership. The proposal lost by about 350 votes in February, 1946.

The fight for municipal ownership started after the Georgia Power & Light Co franchise expired in January, 1945. The franchise has not been renewed.

Must Rescind Franchise

A franchise granted December 17, 1945, to the Walla Walla Electric Cooperative, Inc, for operations along roads and streets in the vicinity of College Place, Wash., must be rescinded by the Walla Walla Board of County Commissioners. The State Supreme Court in a 4-to-1 decision said the commissioners had "acted arbitrarily" in granting the franchise. Seventy residents of College Place and the Pacific Power & Light Co brought the suit opposing the franchise.

SEC RULINGS

WASHINGTON (D.C.) RAILWAY & ELECTRIC Co has received authority to sell its holdings of Capital Transit Co's stock to its own common stockholders. The stock, consisting of 120,000 shares, will be offered at $20 each on the basis of two shares of Transit for each Washington common share held. Proceeds, together with treasury funds, will be used by Washington to pay off $2,800 000 of bank loans. (Release No. 7703).

FEDERAL LIGHT & TRACTION Co's liquidation plan has been approved. FL&T is a subsidiary of Cities Service Co. Holders of the 42,691 shares of preferred, under the plan, would receive $100 a share in cash, plus accrued dividends. Holders of 524,903 common shares would receive for each share held $11 in cash and one common share of Public Service Co of New Mexico and one common share of Federal Liquidating Corp. Federal would transfer all undistributed assets to the liquidating corporation in e change for all the latter's 524,903 common shares and its assumption of the remaining liabilities of Federal. The liquidating corporation was recently formed by Federal as a vehicle for consummating the plan. The commission ordered the hearing to be reconvened October 29 to determine what amount, if any, the preferred stockholders are entitled to receive in excess of $100 a share and accrued dividends. Cities Service, as owner of 339,639 common shares of Federal, would receive $3,736,029 cash and 339,639 common shares of both Public Service of New Mexico and Federal Liquidating Corp. As holder of 1,470 preferred shares, the parent would receive $147,000 in cash, plus a certificate of contingent interest. Cities Service plans to sell the shares of Public Service of New Mexico as soon as practicable. (Release No. 7701).

INTERSTATE POWER Co's plan to issue and sell under competitive bidding new securities as a part of its reorganization plan has been approved in a supplemental order. The SEC approved the plan last January but reserved jurisdiction over several provisions. Interstate Power will sell $19,400,000 of first mortgage bonds. Its reorganization plan carries alternatives. If the first alternative is made effective, the company will sell competitively enough common stock to provide $18,610,500. Successful bidders for the stock also may buy 10.084 percent of the balance of 3,000,000 authorized new common shares. Should the second alternative become effective, Interstate Power will sell enough of its common stock to provide $8,635,000 and will deposit the balance of the new 3,000,000 shares in escrow with the Chemical Bank & Trust Co of New York. (Release No. 7707).

DUQUESNE LIGHT Co, Pittsburgh, has been permitted to sell at competitive bidding $75,000,000 of 30-year first mortgage bonds to pay off its 3½ percent first issue, due June 1, 1965. Proceeds will be used for corporate purposes and to finance a part of its construction program which, between now and 1952, calls for an expenditure of $56,000,000. A subsidiary of Philadelphia Co, Duquesne Light will vote its capital stock holdings in the Allegheny County Steam Heating Co in favor of a stock increase from 80,000 to 95,000 shares, prior to the bond sale. Allegheny then proposes to issue and sell to Duquesne 33,000 shares of capital stock at par of $50 a share to satisfy a $1,650,000 promissory note due Duquesne from Allegheny. Duquesne would then buy an additional 13,000 shares of capital stock for $650,000, after which Allegheny would pay the former a capital stock dividend of $1,200,000. (Release No. 7712).

NEW ENGLAND PUBLIC SERVICE Co's alternative plan for the retirement of its 178,747 shares of prior line preferred stock has been approved. Holders of the company's $6 and $7 dividend preferred would receive cash payments of $161.12 and $171.31, respectively, under the plan, plus certificates for such additional amounts, not exceeding $10 and $20 respectively, as may be determined by final order. Preferred stockholders who do not choose to take the cash may take common stock of Nepsco's subsidiary, Public Service Co of New Hampshire. The plan sets $35 a share as the price at which the New Hampshire stock may be taken in lieu of cash. It was estimated Nepsco would need from $2,500 000 to $16,000,000 in additional cash to retire its preferred stock, depending upon the extent to which the stockholders may elect to take New Hampshire stock in lieu of cash. Nepsco has arranged to borrow up to $16,000,000 from the First National Bank of Boston and four other banks to cover the retirement of the stock. Within one year after the date of the loan the company proposes to sell at competitive bidding sufficient of its holdings of utility stocks to repay the loan in full. North New England Co, parent of Nepsco, owns 2.025, or 1.7 percent, of the $7 preferred and will exchange its shares for New Hampshire common. SEC stated that Northern New England, parent of Nepsco, "appears to serve no useful function," and an order will be issued in the near future to show cause why it should not be liquidated. (Release No. 7713).

BARTHOLOMEW A. BRICKLEY, a registered holding company in his capacity as Trustee of International Hydro-Electric System, also a registered holding company, received commission approval of a proposal to make a payment of 30 percent of the principal amount of International's presently outstanding convertible 6 percent gold debentures, due April 1, 1944, amounting to the aggregate sum of $7,970,400 on the $26,568,000 principal amount of debentures now outstanding. After the date of such partial payment, these debentures shall bear interest only on the unpaid balance. (Release No. 7714).

CONSUMERS POWER Co's proposal to sell $25,000,000 of first mortgage 30-year bonds through competitive bidding has been authorized. The SEC authorized the company to transfer $10,607,836 from earned surplus to common capital stock account. Proceeds from the bond sale will be used for property improvements. (Release No. 7711).

MONTAUP ELECTRIC Co has been granted permission to issue and sell to Brockton Edison Co, one of its parents, 3,576 shares of its common stock at par ($100 a share), and to use the proceeds, together with other funds, for expenditures now being made for capital additions. (Release No. 7710).

WISCONSIN PUBLIC SERVICE CORP, Milwaukee, received permission to borrow $2,600 000 from banks on notes to finance temporarily construction costs. (Release No. 7706).

MEETINGS

Previously Listed

Interstate Power Club of New York—Fall Meeting, Hotel Martinique, New York, September 29.

International Association of Electrical Inspectors—Southwestern Section, Mission Inn, Riverside, Calif., September 29-October 1; Western Section, Mount Royal Hotel, Montreal, Canada, October 13-15; Eastern Section, Seaside Hotel, Atlantic City, October 20-22; Southern Section, George Washington Hotel, Jacksonville, Fla., October 27-29.

Edison Electric Institute—Purchasing and Stores Committee, Henry Grady Hotel, Atlanta, Ga., September 29-October 1; Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, October 6-7; Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, October 6-7; Transmission & Distribution Committee, Benjamin Franklin Hotel, Philadelphia, October 9-10.

National Farm Electrification Conference—Claypool Hotel, Indianapolis, October 7-8.

International Association of Electrical Leagues—Annual Conference, Statler Hotel, St. Louis, October 8-11.

Canadian Electrical Manufacturers Association—Annual Meeting, General Brock Hotel, Niagara Falls, Ont., October 9-10.

Electrochemical Society—Fall Congress, Copley-Plaza Hotel, Boston, October 15-18.

Missouri Valley Electric Association—Accounting Conference, President Hotel, Kansas City, Mo., October 16-17; Rural Roundtable, Skirvin Hotel, Oklahoma City, Okla., October 30; Sales and Rural Conference, Skirvin Hotel, Oklahoma City, Okla., October 31-November 1.

Pennsylvania Electric Association—Transmission & Distribution Committee, Fort Ligonier Hotel, Ligonier, Pa., October 16-17; Prime Movers Commttee, Benjamin Franklin Hotel, Philadelphia, October 23-24; Systems Operation Committee, Irem Temple Country Club, Dallas, Pa., October 23-24; Communications Committee, Lord Baltimore Hotel, Baltimore, November 13-14.

American Standards Association—Annual Meeting Waldorf-Astoria Hotel, New York, October 21-23.

National Electrical Manufacturers Association—Annual Meeting, Hotel Traymore, Atlantic City, October 27-31.

Southeastern Electric Exchange—Sales Conference, Biltmore Hotel, Atlanta, October 29-31.

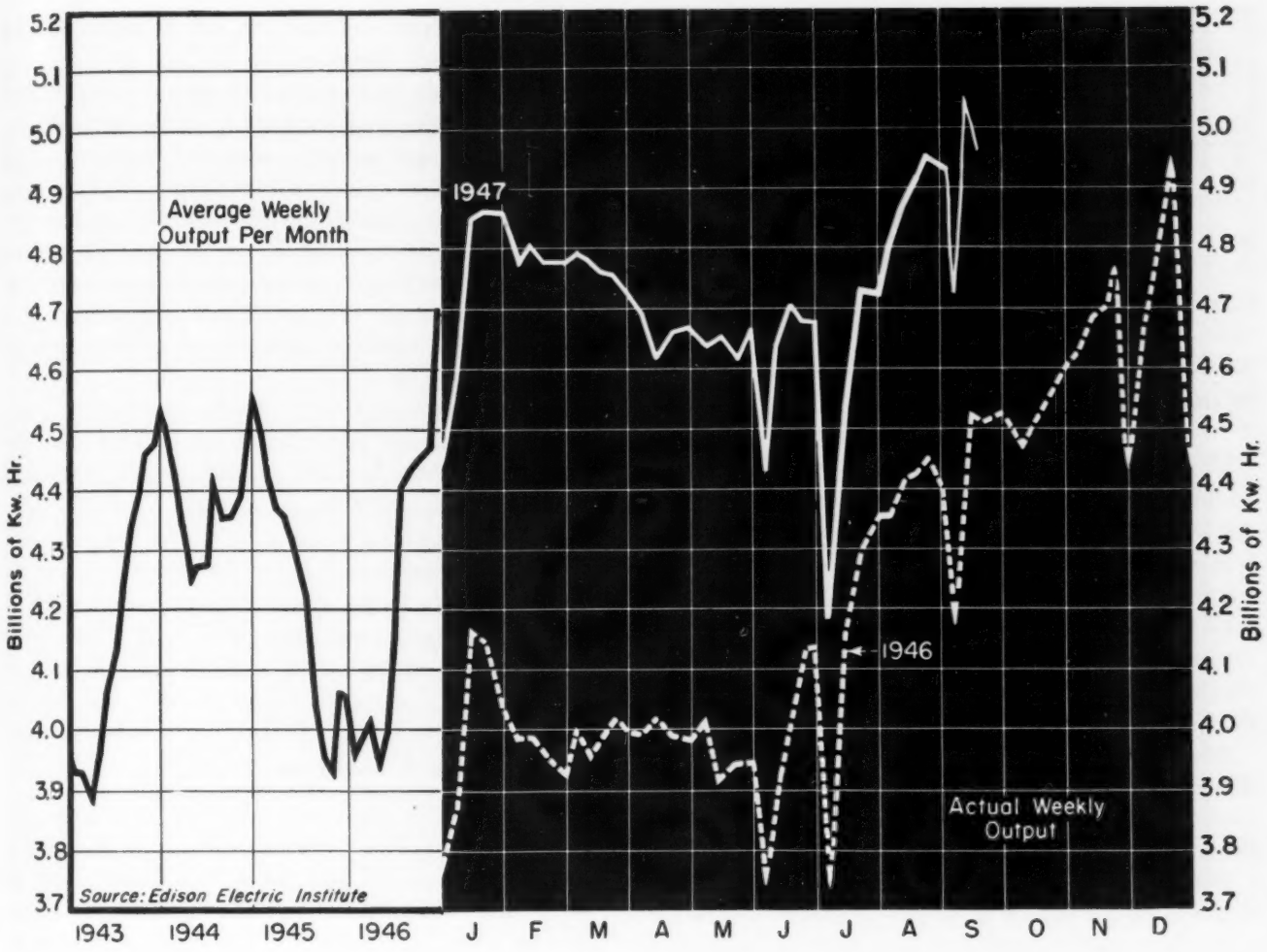
National Electronics Conference — Edgewater Beach Hotel, Chicago, November 3-5.

American Institute of Electrical Engineers—Midwest General Meeting, Congress Hotel, Chicago, November 3-7.

International Lighting Exposition and Conference—Stevens Hotel, Chicago, November 3-7.

Would Export to Canada

Central New York Power Corp, Syracuse, has filed an application with the Federal Power Commission for authority to export electricity to Canada. The power would cross the border on a transmission line running from Hogansburg, N. Y., to facilities of the Shawinigan Water & Power Co near the St. Regis Indian Reservation in Quebec Province.



Time for Filing Anti-Red Oaths Extended by NLRB

The National Labor Relations Board yielded to the realities of a ticklish situation last week and delayed, until October 31, the blanket dismissal of some 5,000 pending cases because of the failure of the top CIO and AFL officials to file non-Communist affidavits.

This tactical retreat defers a showdown until after the AFL and CIO conventions during the first two weeks of October. In fact, it may avert a crisis if both conventions vote to comply with the affidavit requirement and are able to get AFL's John L. Lewis and the CIO chiefs to sign on the non-Communist line. But this is not likely.

Lewis, president of the United Mine Workers, as 11th vice-president of the AFL, is blocking compliance by the AFL officials, most of whom favor signing the necessary oaths. CIO heads, on the other hand, are opposed to compliance with the ruling of NLRB General Counsel Robert N. Denham. The CIO convention seems certain to back them.

CIO's Utility Workers Union of America is in a "spot." It recognizes that employees in the utilities as a rule prefer peaceful procedures to strikes and that many state laws, as well as public sentiment, make striking for them difficult. In some states strikes are illegal. Therefore, UWU needs NLRB assistance, and its officers are prepared to qualify under the law. UWU's situation will be still more critical if the IBEW qualifies and it doesn't.

So UWU is marking time. It is discouraged from qualifying by the present CIO policy against the non-Communist affidavits and for the further reason that, under the Denham ruling, it would not do them any good without the top CIO officers in line.

If Denham's ruling is changed, the UWU will qualify. If it is not and the CIO persists in its present position, UWU will appraise its plight at its second annual convention opening October 24 in Buffalo.

Other News

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Output Moves Downward

The electric output curve moved downward during the week ended September 20, 1947, from beyond the 5,000,000,000 mark reached the preceding week, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power companies of the country totaled 4,977,141,000 kwhr, comparing with 5,053,300,000 kwhr during the week ended September 13. During the week ended September 21, 1946, the total was 4,506,988,000 kwhr.

Weekly Output, Millions Kwhr

1947		1946		1945	
Sept. 20	4,977	Sept. 21	4,507	Sept. 22	4,019
Sept. 13	5,053	Sept. 14	4,521	Sept. 15	4,106
Sept. 6	4,721	Sept. 7	4,184	Sept. 8	3,909
Aug. 30	4,940	Aug. 31	4,104	Sept. 1	4,137
Aug. 23	4,953	Aug. 24	4,444	Aug. 25	4,116
Aug. 16	4,923	Aug. 17	4,422	Aug. 18	3,939
Aug. 9	4,874	Aug. 10	4,412	Aug. 11	4,395
Aug. 2	4,806	Aug. 3	4,351	Aug. 4	4,432
July 26	4,730	July 27	4,352	July 28	4,435
July 19	4,372	July 20	4,293	July 21	4,385
July 12	4,531	July 13	4,156	July 14	4,295

Percent Change from Previous Year

	Sept. 20	Sept. 13	Sept. 6
New England	+ 6.1	+ 7.7	+ 9.5
Mid-Atlantic	+ 8.8	+10.4	+11.2
Central Industrial	+11.7	+11.5	+13.2
West Central	+11.4	+12.9	+14.4
Southern States	+11.7	+13.9	+14.0
Rocky Mountain	+16.0	+18.6	+20.1
Pacific Coast	+ 7.8	+ 9.9	+10.7
Total United States	+10.4	+11.8	+12.8

Electrical World
OPINION

Wider Atomic Horizons

WHEN scientists first split a uranium atom, it was continuing news only in the highly technical journals. Such items as in 1939 described Dunning and Fermi getting high-energy release from uranium got only a brief play from city editors.

Glenn Seaborg announced last week that the University of California group had split lead, bismuth, thallium, platinum and tantalum. This news made page one in newspapers from coast to coast. Indeed, it should.

Seaborg hastened to assure everyone that none of these elements could support a chain reaction. Thus, political controls will not be necessary. We can rest easy about the intentions of storage-battery makers.

But what is the practical use of splitting a lead nucleus? Seaborg did not say. It is doubtful if anyone can be specific. Scientific research concerns itself primarily with extending the boundaries of human knowledge, not with promoting commercial ventures.

If the discovery of uranium fission marked a high point in man's study of this universe, the new knowledge of how to attack any nucleus directly stands higher, as the Alps stand above their foothills. The first compares with the discovery of fire, the second with the beginnings of the theory of combustion.

Long ago the Acheson-Lilienthal report on control of atomic energy recognized the need for more scientific research directed at true understanding of nuclear forces. Only by leading in research, it said, can we better understand what enemies might use for weapons. Applying the same straight thinking to long-term commercial development, it is important to recognize that the nuclear reactors of today are only the Franklin stoves of atomic energy.

Wanted—Inventions

ACCORDING to report of recent investigations, it is possible to raise the light production efficiency of the fluorescent lamp as much as 65 percent above present levels. This can be done by increasing the frequency of the energy supply from the present 60 cycles to around 600. Raising the frequency will also allow a major reduction in size, weight and losses of auxiliary equipment. Further, the starting characteristics of the lamp will be improved and stroboscopic effect minimized.

All this depends on the availability of a practical means for supply of higher-frequency energy to the lamp. There are plenty of ways known for changing frequency. But in their present forms, none of them fills the bill as to cost, size and simplicity required by this particular application.

We can be quite sure that the operation of fluorescent lamps at optimum frequency will come some time. A way will be found sooner or later. Some one will adapt a known method of frequency changing or possibly come up with a brand new idea.

Yet, according to reports of surveys and inquiries, engineering students are generally of the opinion that the electric power industry holds out little or no promise to them. They seem to think that everything for the industry has been invented, that it has no place for the agile and original mind. Maybe it would be a good idea to compile a statement of the technical problems and possibilities of electricity supply and use, then publicize it, particularly to the younger generation.

Unorthodox Unionism

PSYCHOLOGISTS teach their elementary students that an easy way to solve a knotty problem is to discard the conventional approach and get at the matter from an unorthodox, unobscured angle. It is interesting to speculate upon what might result if various national and international labor unions were to apply this precept to a problem which is one of the knottiest they face today.

Many unions affiliated with the AFL or the CIO want to use the facilities of the National Labor Relations Board. Among them are the IBEW-AFL, and the UWUA-CIO. But, under an interpretation of the Taft-Hartley Act by NLRB General Counsel Denham, no union may use NLRB unless all its officers and all officers of any parent group —the AFL and CIO, to be bald about it—file anti-Communist affidavits with NLRB. Thus, both IBEW and UWUA face a very knotty problem—how to use NLRB in view of the determination of certain AFL and CIO officers not to file the anti-Communist affidavits?

The orthodox solution lies in litigation of the Denham ruling. It might or might not be validated, either by NLRB or the courts. IBEW has undertaken suit to follow this course, and certain CIO people have indicated that they will. They take this position, we feel sure, in all awareness of its defects. Litigation is often lengthy and generally expensive. It may become moot. Most important, it may be won or lost.

Since those who would litigate the Denham rule could very well lose their case, we wonder if they wouldn't be wise to try the unorthodox approach to their very real problem. What is their aim? It is to avail themselves of the facilities of NLRB. What balks them? Refusal of their parent officers to abide by the Denham rule. How,

other than by litigation of that rule, could they achieve their aim? By withdrawing from the parent organization.

This sounds drastic. But is it unrealistic? We think not. After all, neither the AFL nor the CIO as such need NLRB for continued daily existence. But both IBEW and UWUA may very well need it. Why should their parent organizations, which by themselves do not represent a single employee of the electric utility industry, forbid the law's benefits to groups which do represent these workers? Both AFL and CIO are top coordinating groups which have real functions in the development of a strong organized labor movement. But they are, say, as the holding company to the operating company. They do not produce the product which is sold. When they interfere with the production and sale of the product, they can be shed. In the case of IBEW and UWUA, AFL and CIO can be shed much more easily than holding companies could be.

Nor is there anything new about a union's withdrawal from either. John Lewis, who is the main obstacle to the IBEW in this situation, withdrew his miners from AFL a dozen years ago, and formed the CIO on them. He withdrew them from the CIO and remained independent for a spell, before rejoining AFL. The Typographical Union, the Brewery Workers and the Machinists withdrew from AFL. The Machinists are still independent, and today, consider themselves lucky. It's an old, and not rare, story.

Because neither the AFL nor the CIO has any real function if not to make its members more effective, we think the idea of withdrawal is in point in this instance. We think that a few well chosen withdrawals might settle the problem—without the delay, expense or danger of losing which is entailed in litigation.

Recovering Lost Ground

GOOD-BYE to the incandescent lamp. That was how a lot of folks felt—and feared, some of them—when fluorescent lighting first made its bow. But those hopes and fears quickly evaporated. Very soon it became apparent that the old standby had qualities and virtues that would keep it out of the "has-been" class for a long time.

Latest evidence that the incandescent lamp is far from finished, in fact is recovering lost ground, comes from a publication of the Division of Research of Harvard's School of Business Administration. Here, under the title "Good Lighting for People at Work in Reading Rooms and Offices," are described the studies and tests and the changes made to improve the lighting in a large library reading room and in several of the school offices.

Regarding fluorescent, the readers participating in the tests characterized the quality of light as "thin," "harsh," and "cold," in comparison with daylight and with light from incandescent lamps. These results, combined with other evidences of eye-fatigue, irritation, and discomfort, ruled fluorescent out of consideration in the improvement plans.

WASHINGTON COMMENT

W. B. WHICHARD

INTERIOR'S power planners, long among the most active and astute federal administrative groups, are back in business at the old stand. Briefly, last summer—when Congressional economy threatened their programs—they seemed almost ready to quit. Their activities, even their thinking, shifted from the aggressive to an unhappy defensive.

But now, apparently, they have recovered their morale. Once again, they are building the power empire whose foundations Harold Ickes laid. Illustrative is the Department's latest plan to compromise the Colorado River dispute.

Only the hardy would attempt such a feat now. Interior has been trying, off and on, for 30 years. In 1922, the Reclamation Bureau came up with the Colorado River compact, an agreement among the seven basin states for a preliminary division of the river waters. This pact permitted federal construction of Boulder, Parker and Davis Dams. Every subsequent effort at compromise has failed. Now, the squabble has attained new bitterness.

The problem is elementary. The Colorado simply has not sufficient water for all uses. The obvious solution is another compact, further dividing the water. But no state wants to give up any of its pet projects.

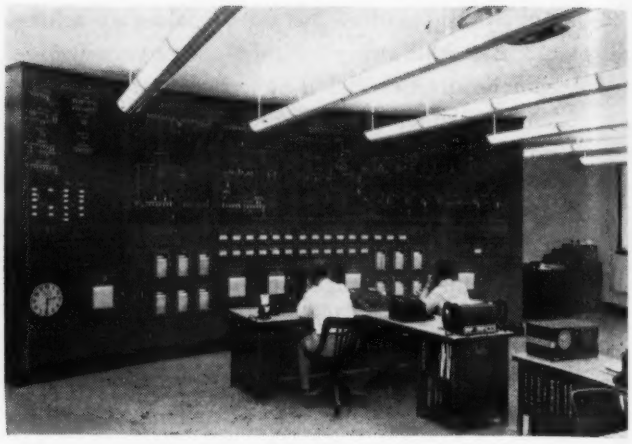
Last year, when Reclamation suggested that the states list "priority projects," this attitude became clear. Each labelled most of its proposals "urgent." Several even suggested that the only solution lay in the Supreme Court.

Litigating claims of the several states disturbs Interior. It knows that such a legal battle might rage for decades. Meanwhile, all plans for developing the stream and its tributaries would languish. Interior is anxious to start a $2,000,000,000 Colorado River construction program. Power projects represent no small part of it. Interior figures that 3,648,400 kw are "feasible" in the area. These plants would pay most of the reimbursable costs of the entire program.

Interior officials already have sounded out several basin-state groups on the possibility of permitting the hydro projects to go forward. Interior argues that such dams could be built, providing power and flood control benefits, without effect on any other use of the waters. The only water "consumed" would be the comparatively small loss by evaporation. When—and if—the basin states come to terms on division of water, canals and other irrigation features can be built.

This scheme already is catching on in several states. It will be brought into the open at the National Reclamation Association convention in Phoenix, October 29-31. If it gains complete success, Interior is likely to take little further interest in the water allocation scrap.

ENTIRE SYSTEM is portrayed on 64-ft arc of 20½-ft circle. No lights are used on the board



GENERATORS AND TIE-LINES are represented on 24-ft arc of 26-ft circle. Operators' desks in double T-arrangement between the boards

System Board of Aluminum Uses Colored-Tape Diagrams

EUGENE S. BAILEY
Supt, Power Transmission Stations
Consolidated Gas Electric Light & Power Co
Baltimore, Md.

Baltimore utility in dispatching center detached from plants has developed new perforated-metal panel board that uses symbol plugs to achieve simplicity and adaptability

LOAD DISPATCHING facilities of the Consolidated Gas Electric Light & Power Co of Baltimore were modernized when the system operating center moved from the main generating station to an uptown building. Prior to 1919, load dispatching for the Baltimore electric system was performed by the operator of the Westport Generating Station. He regulated the capacity and loads of that day while performing the duties of station and substation switching. By 1919, however, station capacity and loads had increased and the electric system served a much larger area. It became necessary to divide the duties of the Westport operator by forming a separate load dispatching organization. The dispatchers used a system board of wood, on which lines, cables, and substations were painted. The board was plugged for switches, but there were neither lights nor meters.

These early facilities were short-lived. In 1924 it was necessary to remodel the Westport switch house and control room. Two years later a steel board was built in the new control room for the load dispatchers. Flat-black paint was used on this board. On it a sign painter drew the station diagrams in color. Red and green lights were monitored from the dispatchers' desk. A few meters were provided.

Rapid expansion at Westport by 1931 made it necessary to provide more space in the control room for new feeder and relay panels. A separate room was built for the load dispatchers adjacent to the control room. It was felt that the dispatchers should be in the major generating station to supervise the operator in the event of major trouble. Existing facilities were relocated and new sections of similar material were added to the board. A number of telemetering circuits were installed for important loads. These facilities were used for 15 years. During this time the electric system continued to grow and the load dispatching equipment became completely inadequate.

When we decided in 1944 to replace our load dispatching facilities, two major factors were considered: —First, location; second, type of board construction. We had had experience with a generating station location and with boards drilled for lights, both automatically and manually controlled. Nevertheless, we studied the experience of other companies, particularly those, like our own, where dispatchers also supervised system switching. Representatives of the company visited and studied the load dispatching facilities of ten companies.

Our dispatching quarters have always been at a generating station, adjacent to the 13,200-volt switch house, control room, and high-pressure boiler house. External noises disturbed the dispatchers. There was always the possibility of trouble in either the switch house or the boiler house causing an outage of the facilities. Furthermore, the removal of the dispatchers as direct supervisors of the generating station operators appeared to have mutual advantages rather than disadvantages.

For these reasons the dispatchers'

quarters were moved to a quiet location in our Madison Street Building. Here the dispatchers would be more closely coordinated with the personnel of their own department (power transmission stations) and they would be near the electrical engineers and electric distribution departments. There were mutual advantages in this proximity.

Choice of Board Construction

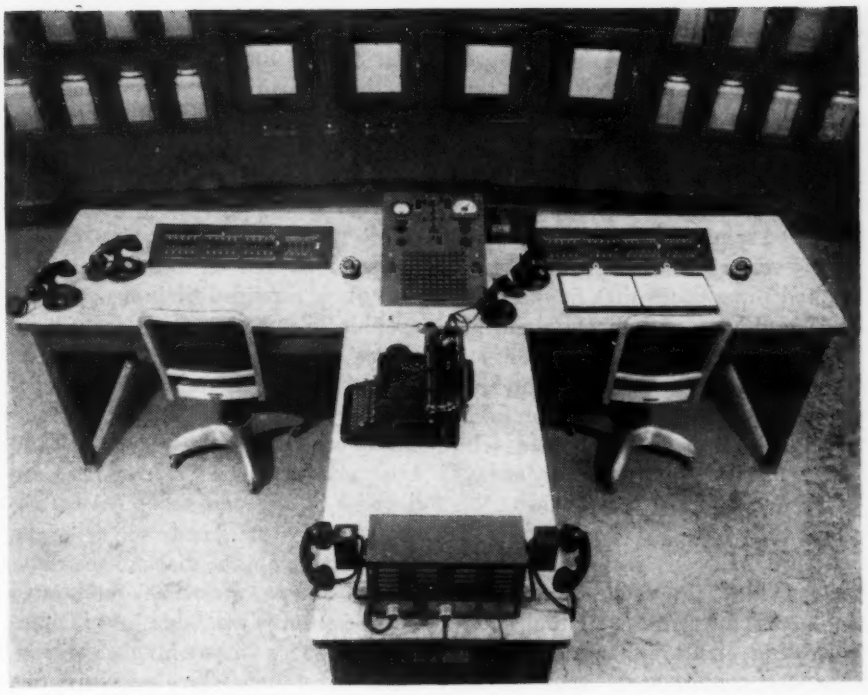
The existing steel board used by the dispatchers had been extended to its physical limits. All available space on it had been covered with substation diagrams. Since the steel board had been drilled, a large amount of work would have been necessary to re-use it. All hope of salvaging it was abandoned.

We had found it laborious and costly to keep this board up to date. Drafting, drilling, wiring, and painting operations were involved with all changes. Therefore, we decided to forego the use of lights for switch indications and develop a board that the dispatchers themselves could easily change. Here our visits to other utilities proved profitable. Many of the excellent ideas obtained were incorporated in the design of our new facilities. After careful planning and testing we decided to build the board of aluminum panels, punched, painted, and diagrammed with colored paper tape. It appeared that such design and layout would best meet our requirements.

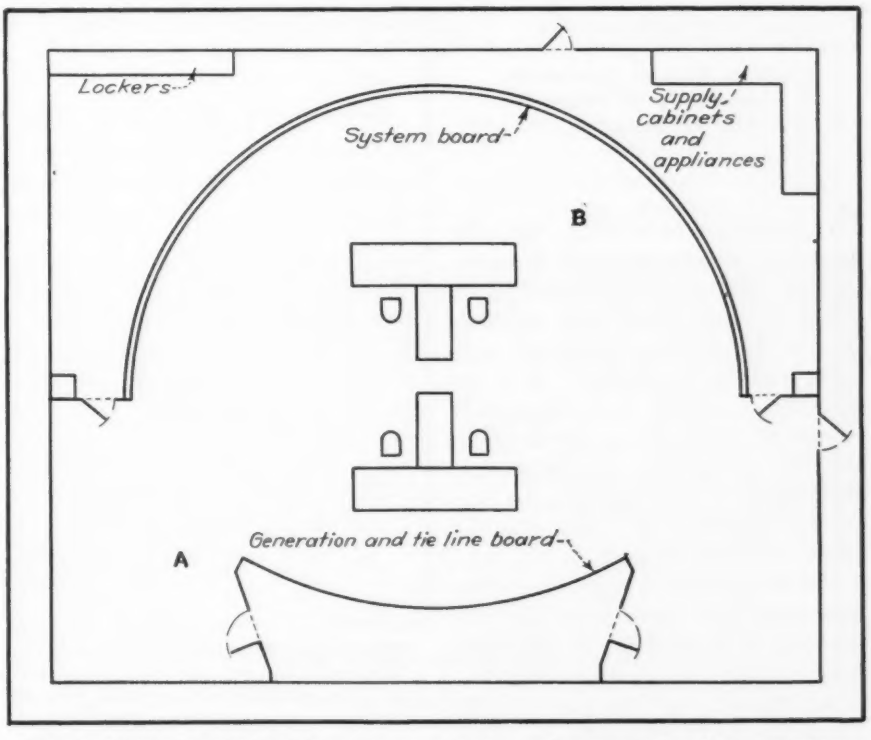
New Facilities

Work on the new load dispatchers' office began in the fall of 1945. A space (48 by 40 ft) without columns was selected on the fourth floor of our Madison Street Building. The room is air conditioned. It has fluorescent lighting, emergency incandescent lights, acoustical treatment, and an engineered color scheme.

The two $\frac{1}{8}$-in. aluminum diagram boards are coated with "load dispatchers' green" lacquer. Prior to assembly the boards were punched with 0.101-in. holes to break up the otherwise flat, hard surface, to provide a guide for diagrams and holes for plugs and to give acoustical advantages. One board, consisting of sixteen 12- by 4-ft panels, is semicircularly arranged with a radius of 20 ft 6 in. It carries the diagram of the Baltimore system.



INSTRUMENT PANEL at the center of the dispatchers' table carries the generator supervisory lights and two instruments; at the left is one showing the deviation of tie-line load from scheduled value and at the right one showing the total steam capaciy in operation. In the foreground is the monitor for the short-wave radio system. Telephone boards flank the generator panel on each side



DISPATCHING BOARDS laid out in semi-circular and segmental pattern. Positions A and B are approximate locations of camera for the photographs

The other board is a 24-ft segment of a circle with a radius of 26 ft. It is 12 ft high, aluminum and steel, and carries a diagram showing the generator and tie-line facilities of power areas No. 5 and 6. This board is equipped with indicating and graphic instruments. Axes of the two boards are on the same line; they face in and are separated about 32 ft.

Two, two-position, T-shaped special

steel desks are between the two boards. Diagrams on both boards consist of adhesive-coated paper tape that adheres well to the boards and can be removed easily without damage to the finish. The tape is sized and colored to correspond with the preferred scheme for indicating buses and circuits at various voltages. Painted brass plugs that fit the small holes in the board indicate abnormal conditions. Diagram changes are made readily by the dispatching forces at the time changes or additions are completed in the field, with the result that the board is always a true facsimile of the system.

Two complete telephone key positions (30 lines each, company owned) are provided for each desk. Telephone circuits from all Baltimore generating plants and major substations are connected to each of the four positions. In addition, seven Bell System lines terminate adjacent to these positions. The telephone equipment is not arranged for conference connections.

Instruments Illuminated

All necessary information on the system load and on most of its components is provided by indicating and graphic telemeters. This feature includes generating station and tie-line loads as well as a total capacity graph. Time and time-difference clocks together with frequency, voltage, and weather instruments are likewise board-mounted. All instruments are illuminated, so as to be easily read from the dispatcher's desk.

A two-way frequency-modulated radio station is available in this office for emergency dispatching of personnel to substations. This station is one of a number of company stations which are utilized in connection with trouble calls.

Necessary lockers, supply cabinets, and appliances for use of the dispatching personnel are located behind the system diagram board. This arrangement lends itself readily to the keeping of a neat and orderly house.

Installation of these modern facilities was completed in May, 1946. A schedule for transfer of control from the old office to the new one was prepared. On the appointed day both offices were manned until the transfer was completed. The cut-over of telephone circuits required a period of 16 min, after which the control was shifted to the personnel in the new office. The telemetric circuits were transferred, requiring an additional 19 min to complete the change.

Water Content Unrelated to Steam Emulsion Number

E. M. KIPP

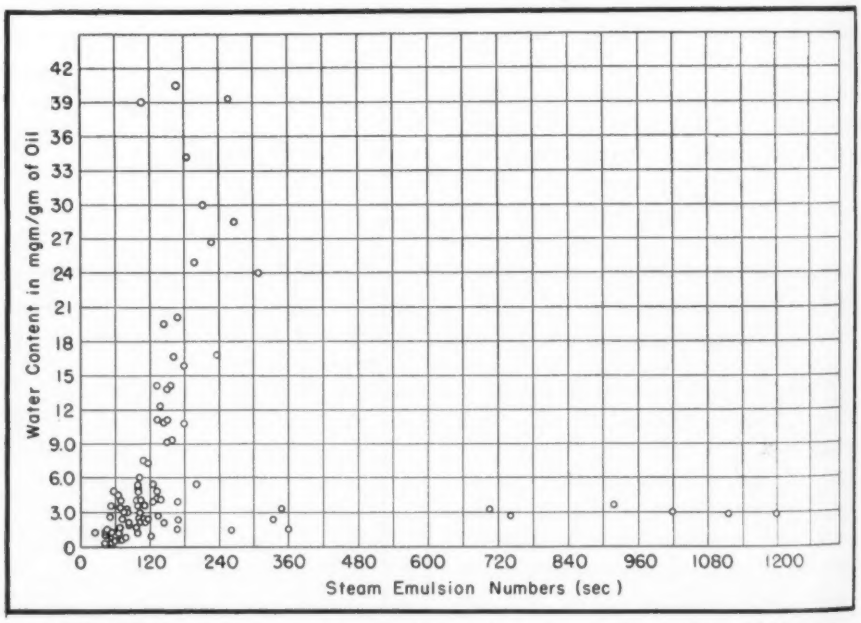
Aluminum Research Laboratories
Aluminum Co. of America
New Kensington, Pa.

STEAM-EMULSION-NUMBER test for insulating oil was inherited from the tests established for turbine oil where it had far more significance and pertinence. In fact, many electrical engineers consider that it has little or no significance for oils used for insulating functions. That conclusion weakens the occasional argument that application of activated alumina frequently results in an increase in the steam emulsion number.

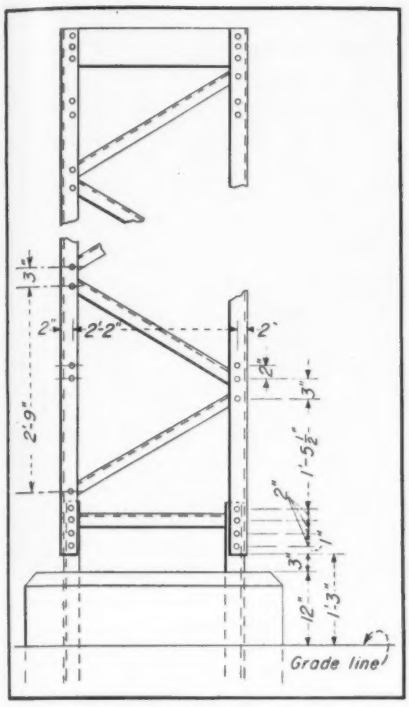
Nevertheless, to clinch this refutation, tests have been made on 110 samples of eleven different oils taken from a variety of transformers in sustained operation at two plants of the Aluminum Co of America. The object was to determine the extent to which the value of the steam emulsion number of an oil correlates any tendency for the oil to adsorb and to retain both dissolved and finely suspended moisture.

Conclusions show that it is unwise to view the steam emulsion number as a reliable index of the quality of the oil or of its tendency to accept and retain water contamination. Also the mechanism of water contamination of insulating oils within a transformer bears little resemblance to the tests prescribed in the ASTM-D-157-36 method.

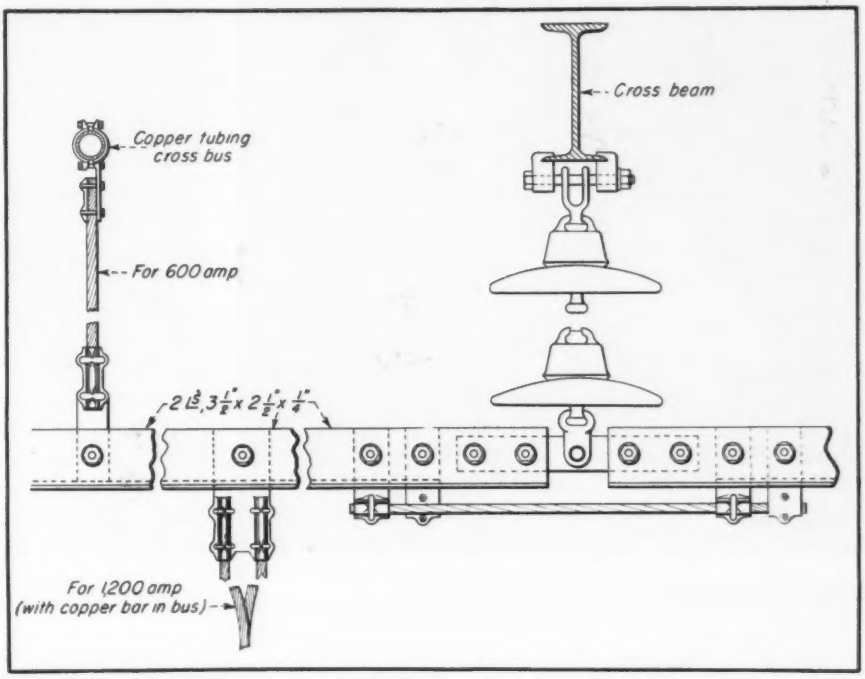
Thirty-minute agitation of 5 ml of water with 90 ml of each oil in a 4-oz bottle produced an emulsion. The bottles were kept in upright position and sampled at the end of (a) an hour and (b) a week. Water content was determined volumetrically by titration with Karl-Fischer reagent. The lack of correlation between steam emulsion number and water content can be seen from the chart.



COMPARISON of steam emulsion numbers and water content of 110 insulating oils. Water content was determined volumetrically by titration with Karl-Fischer reagent. Little or no correlation is evident from these tests



SQUARE COLUMN for 23-kv structure is shop-drilled and shipped to site for bolted assembly with standard units



SUSPENDED STEEL BUS permits simple mounting for relatively long spans on both high- and low-voltage sides of substation. Requires few points of support and does not need elaborate or expensive fittings for expansion

Build Substations From Unit Assemblies

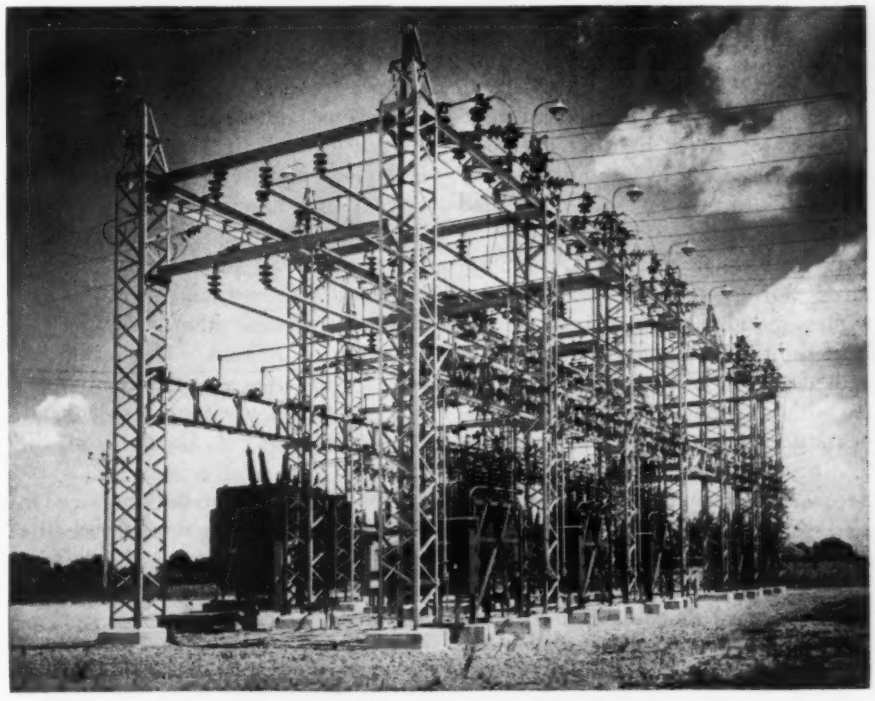
FRANK C. BROGAN
Electrical Engineer
Ohio Public Service Co
Elyria, Ohio

FOUR UNIT ASSEMBLIES are used for all of the major substations that are built for 132, 34, and 23-kv by the Ohio Public Service Co. The columns, beams, and girders for the main structure are shop-drilled and shipped to the site in bundles together with complete assembly details. Each unit is assembled on the ground with bolts before erection. This procedure has the important advantage, compared to welding or shop assembly, of ease in hauling to remote locations.

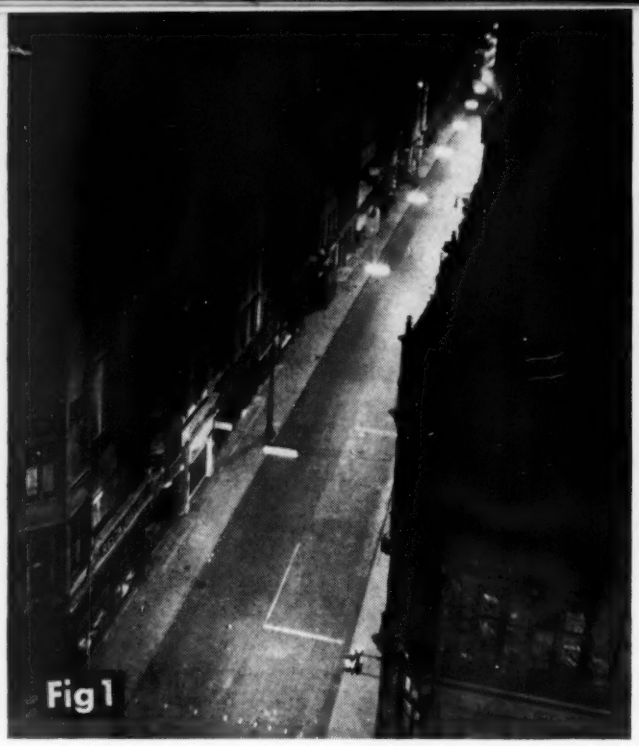
For the 23-kv structure, the standard 2-ft, 6-in. square column is 30 ft long, with 3-in. x 3-in. x $\frac{5}{16}$-in. angle legs. The higher voltage structures require 4-ft x 4-ft x 60-ft columns.

Disconnects, switches, and other equipment units are mounted on beams and girders of the lattice assembly. Steel between front and rear elevations is in single shapes, principally I-beams. These tie sections support the suspension buses.

Steel angle is used for suspension buses in both the high- and low-voltage sides of the substations. This has been found practical and economical for maximum spans of about 30 ft and a maximum conductivity of about 600 amp without reinforcement.

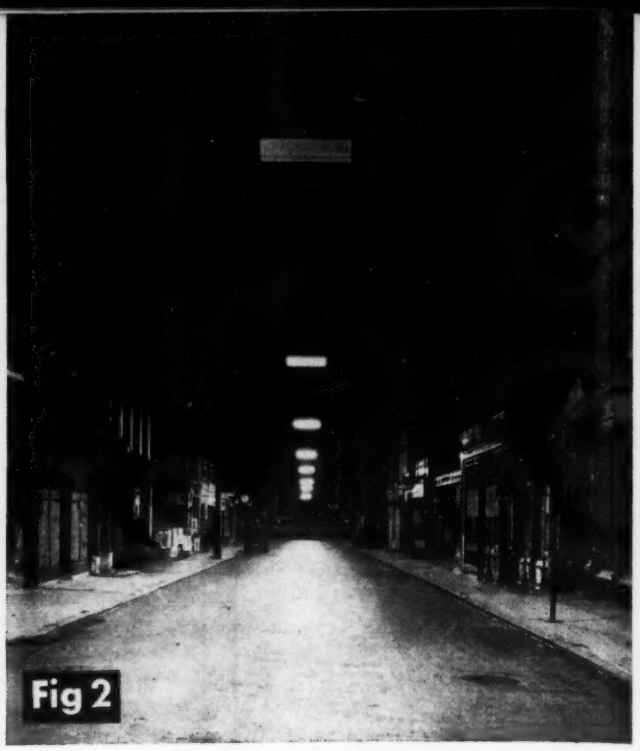


SUBSTATION CONSTRUCTED from standardized iron-work components. Suspended steel angle bus is used for the 23-kv connections



British Thomson-Houston Co, Ltd

CENTER-SUSPENDED luminaires in Old Bond Street



British Thomson-Houston Co, Ltd

CAR AT CURB shows good definition obtained

Fluorescent Street Lighting

Two experimental installations demonstrate practicability of tubes in outdoor use and indicate possible attainment of better lighting and lower cost than from incandescent lamps

F. R. BREWSTER
London Bureau
McGraw-Hill World News

FULL-SCALE PROOF of the feasibility of tubular fluorescent lighting for street lighting has been obtained by Central London Electricity, Ltd, in two recently completed installations.

For the range of London temperatures during two normally severe winter months the test installations have shown that fluorescent lamps can provide dependable starting and service without preheating or continuous-heating equipment. This bears out findings of laboratory tests on 80-w fluorescent equipment under accelerated service conditions and exposed to controlled temperature variations down to —10 C.

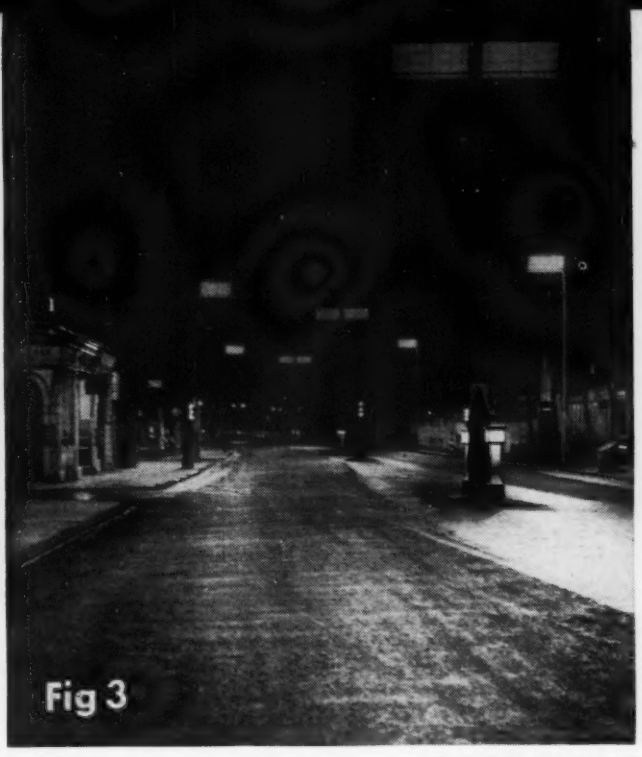
Test showed that this type of lamp would start dependably and run reliably, though with about 20 percent reduction in light output, under such conditions. Earlier laboratory tests had shown that even at 216 (normal voltage of 230 minus 6 percent) these lamps would start reliably at temperatures of —5 C.

As a result of these two London installations, developed separately by British Thomson-Houston Co Ltd and General Electric Co (England) Ltd, numerous inquiries will undoubtedly lead to installations in many of the principal cities of England and Scotland, and in Paris, Madrid and several other cities on the European continent. One such order, for 50 lanterns, has already been placed by the town of Maidenhead, 35 miles west of London on the Thames.

The London installations are in Old Bond Street just off Piccadilly (BTH) and in Brompton Road, Kensington, (GEC). Both of these streets, as relighted, demonstrate a tremendous improvement in the quality of illumination. Visibility is more than doubled, apparent in the adjoining sections of the street; newsprint can be read easily at maximum distance from the lanterns. Definition is markedly improved. Proper silhouette-effect assures increased safety to both pedestrians and motorists. Low surface-brightness of the lamps themselves (only 4-5 candles per sq in. at their brightest point) means that glare and extreme contrasts in the line of sight are eliminated.

A reduction in energy consumption of one-third over comparable intensity incandescent lamps is important. Moreover the three-times life of the fluorescent lamps, (3,000 hr guaranteed, compared with 1,000 hr for incandescent lamps) means a saving in replacement cost. While the initial capital costs for these prototype installations are higher than for incandescent lamps, the outlay may be expected to come down when quantity production of the luminaires is attained this year.

Both fluorescent installations are operated on 230-v, 50-cycle, a-c supply.



General Electric Co, Ltd

BROMPTON ROAD INSTALLATION of seven-tube luminaires, paired and single

General Electric Co, Ltd

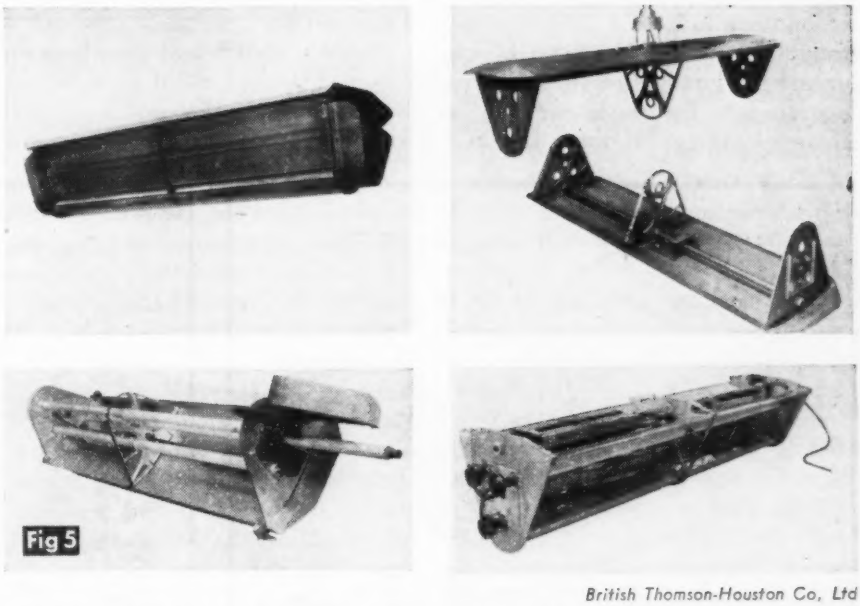
CURB INSTALLATION of seven-tube luminaire. The light is mounted 30 ft above the pavement

Gets Try-Out in London

In lower Old Bond Street, a narrow thoroughfare only 24 ft between curbs and with 6-ft sidewalks to the building line on each side, BTH has installed eight lanterns suspended over the center of the street at a height of 25 ft and spaced at intervals of 80 ft. Each of the units contains three 80-w tubes paralleled in triangular arrangement as shown in Fig 1 and 2.

Lanterns hang on two catenary wires of stranded cable between building walls with turnbuckle tension adjusters. Simple bed plates of steel strap 2½ in. wide, ⅜ in. thick form a shallow "U" 18 in. wide, anchor-bolted into the stonework. Lanterns are carried on the catenary wires by means of a sliding clamp arrangement. A pulley traversing rig secured to one of the span wires enables the lantern to be drawn to one side of the street for servicing. The power-supply flexible cable hangs from the span wire by messenger loops, and leads to a wall box with switches accessible from the sidewalk. Two of the three lamps can be switched off leaving only the bottom lamp burning after midnight when only reduced lighting is necessary.

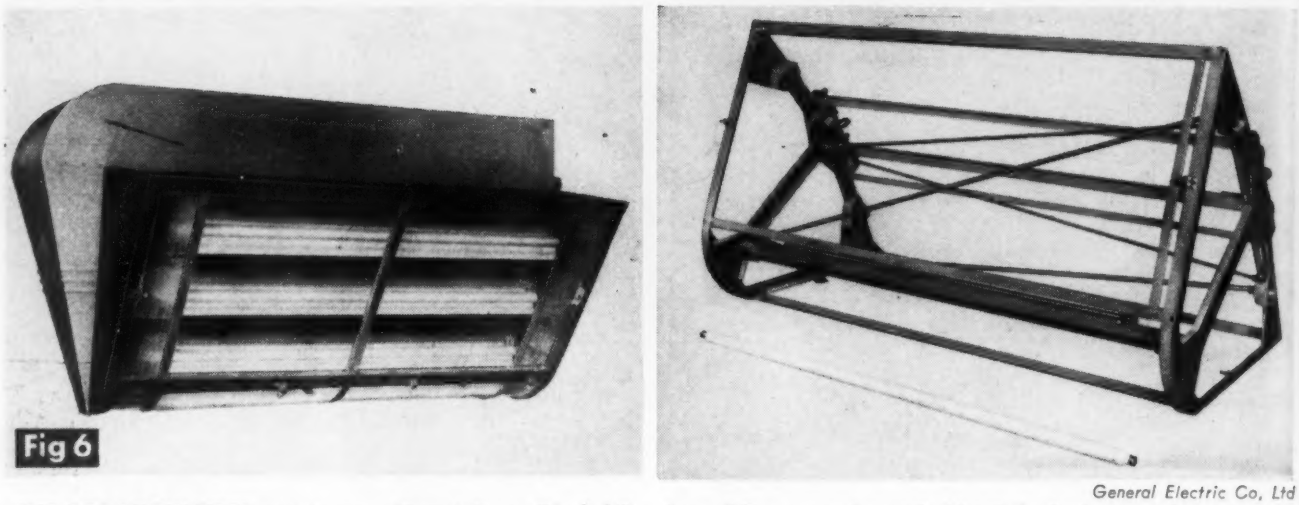
Each 300-w lantern gives more light than a single 500-w tungsten-filament lamp. The complete installation consumes 2,400 w, compared to the 2,250 w of "economy" level illumination by tungsten lamps it replaced, and to 3,750 w of original pre-war illumination.



British Thomson-Houston Co, Ltd

THE LANTERNS installed in old Bond Street each contain three 80-watt Mazda "warm-white" fluorescent lamps 5 ft long, in a "V" arrangement, each with its own anodised aluminum reflector. The lantern framework is three light alloy castings (upper left) on a tubular spar; a sheet alloy roof forms a watershed; and a clear acrylic plastic cover encloses the lower part of the lantern (upper right). Waterproof gaskets keep out the weather. Lantern weighs 65 lb. Over-all length is 67¾ in., width 15¼ in., depth 13 in.

The distribution of light for the height and spacing of the lanterns in Old Bond Street is approximately 8,550 lumens per 100 ft of street-length but a light-distribution curve alone does not fairly measure the



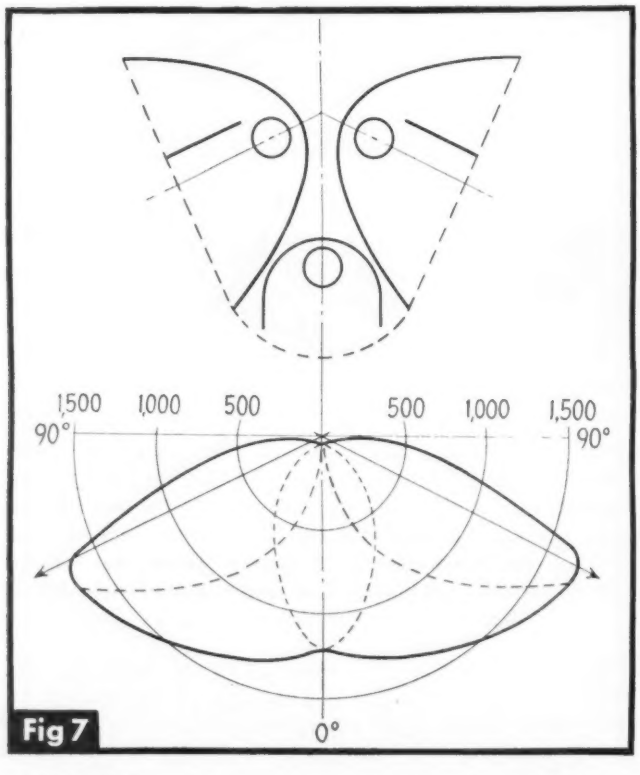
General Electric Co, Ltd

THE GEC LUMINAIRES contain seven 80-watt Osram "daylight" fluorescent lamps, 5 ft long, in "V" formation each with its own parabolic reflector. The luminaires have a framework of light aluminum alloy shapes, two cast alloy end members, and are covered with alloy sheets. Two flat clear acrylic plastic sheets form sliding covers for each side of the luminaire and a rounded sheet makes the hinged cover for the bottom. Complete with its seven lamps, one luminaire weighs 200 lb. Dimensions are 72 in. over-all length, 48 in. maximum width, and 40 in. maximum depth

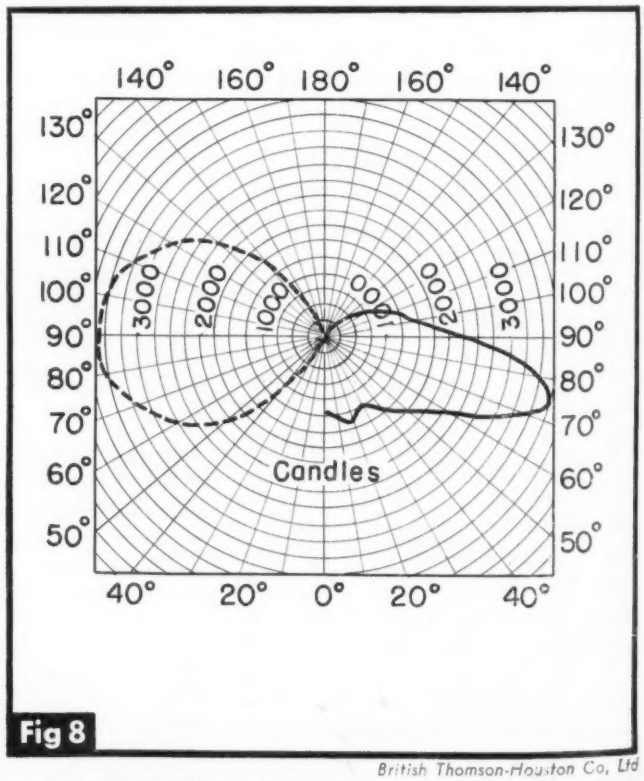
improvement in illumination obtained.

Just west of Harrods, Brompton Road opens into a double-width roadway, with two lanes each 24 ft wide, a sidewalk averaging 10-ft width and a 30-ft paved footway extending to the building line. In a 220-yd, nearly straight portion of this street, GEC has erected ten luminaires, six in paired mountings in the center and four in single mountings at the curb line, two to each side. The luminaires, uniformly 30 ft above the pavement, are irregularly spaced due to difficulty in finding clear footings for the precast concrete columns which support them. Each of these units contains seven 80-w tubes, as shown in Fig 3 and 4.

Starters, chokes and capacitors are mounted in the base of each column. By placing one 12½-mfd condenser in series with two lamps, unity power factor has been obtained; the odd lamps in each luminaire are linked with the odd lamps in an adjoining one. Two or four lamps may be cut-out in each unit for economy operation at reduced output when traffic conditions allow. Chokes are used, tapped every 5 volts, with a maximum loss of 10 watts, permitting variations in voltage supply to be corrected. New type GEC canister starters are disconnected to control lamps.



REFLECTOR and tube arrangement and light distribution of three-lamp luminaire



British Thomson-Houston Co, Ltd

LIGHT DISTRIBUTION of GEC luminaire. Solid line, distribution in vertical plane; broken line in plane 74 deg to vertical

ALL CUSTOMER RECORDS, except account ledgers, are centralized in these visible Kardex files housed in fire-proof safes. Service files, history and meter records for 80,000 customers are located at this one point

Grouped Records Aid Customer Contacts

ROBERT G. SCHNEIDER
Virginia Electric & Power Co
Richmond, Va.

Centralized customer contact records provide more efficient and economical servicing of accounts—Complaints are minimized and customer relations improved

RECOGNIZING THE NEED for a revision of customer contact records and methods, the Virginia Electric & Power Co established a centralized system of customer contacts and records. This system permits all customer contacts to be handled at one location. It was first installed in Richmond where 80,000 customers are served, and was installed later in other large offices throughout the company.

A block plan of meter reading was adopted and the monthly schedule of reading placed on a 21-day basis. This increased the average number of readings per day per reader 38 percent.

A unit plan of bookkeeping is now used with the centralized record system. Fifteen thousand accounts are assigned to each clerk and the account records housed in specially designed fire-proof desks. Each unit bookkeeper is equipped with an intercompany telephone for supplying account information to the customer contact employee at the central point. This eliminates lost motion and confusion, and contributes to increased efficiency. Other advantages include greater speed in handling customer inquiries, elimination of peak loads, and an increase in personnel morale.

All customer records, except the account ledgers, are centralized at one point in visible Kardex files housed in fire-proof safes. These records consist of the customer service files, customer history records and meter records. Telephones are located at these records for outside communication while "intercoms" are used for direct communication with the customer contact employees.

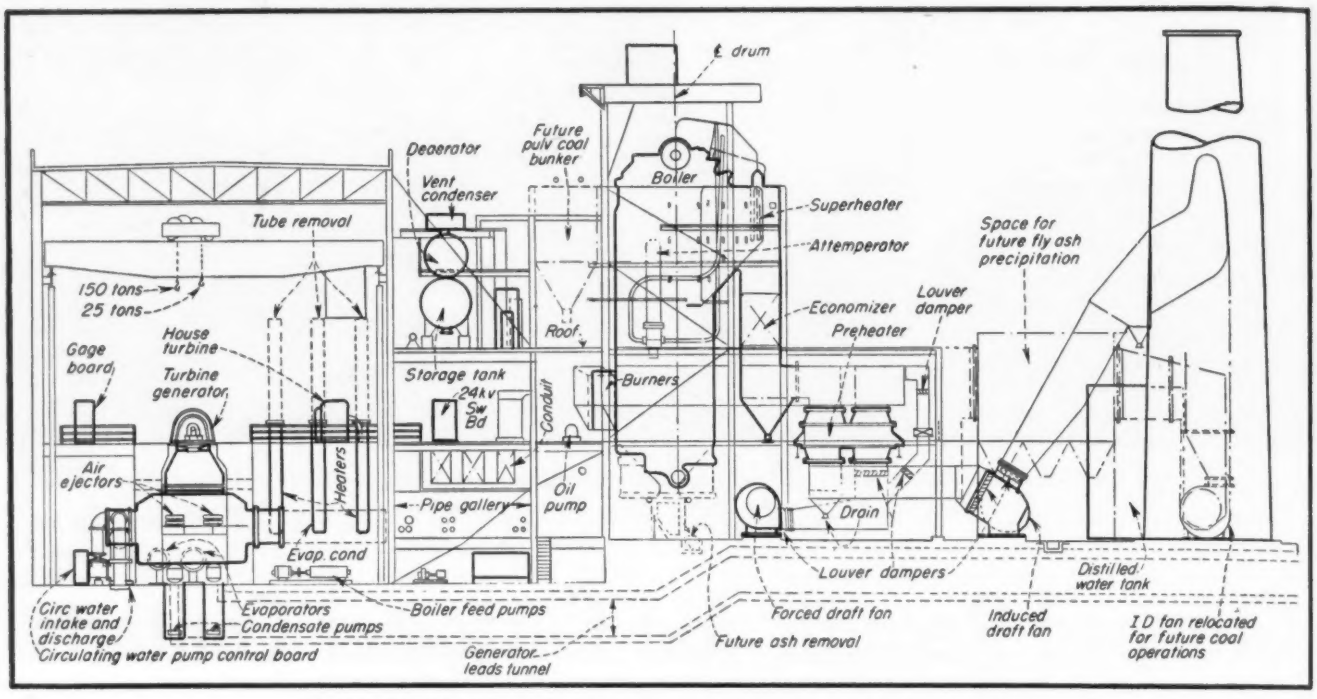
A permanent service order card and customer history record are used. With these, telephone applications are handled as readily as personal applications. Errors are reduced since complete information is available when the order is taken. Transcribing addresses, account numbers and other information is unnecessary, and orders are cleared through all departments within 48 to 72 hr. Auxiliary files and records are eliminated, resulting in a reduction in office equipment and space, and personnel is reduced.

Customer contact functions are consolidated into a single department. All business with customers is handled at this point by one clerk. This consolidation results in improved and accelerated service to the customer. Complaints are drastically reduced.

Interviews and investigations on customers' premises are practically eliminated. Prior to consolidation, twelve employees were needed in the various phases of contact work for 57,000 customers. Six employees now handle the work for 80,000 customers.

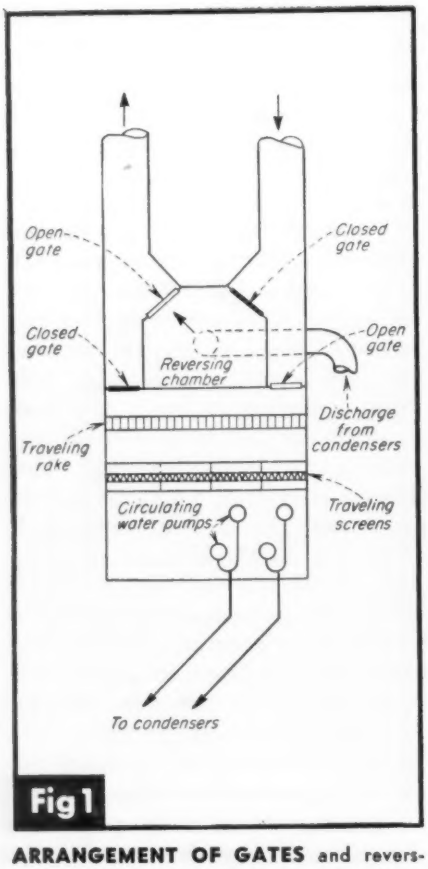
To obtain full value from the centralized records, collection procedure was revised and the collection policy liberalized. Formerly, collection calls were made on all unpaid accounts 15 days after the delivery of bills. Now, collection calls are not made until the account is at least 60 days delinquent. Collection calls have been reduced from a monthly average of 14,000 for 57,000 accounts to 1,300 for 80,000 with a corresponding reduction in collection personnel. There has not been any noticeable increase in the accounts receivable balance and net losses from uncollectible accounts during 1946 were less than one-half of 1 percent of sales. Discount rates have been abolished and all billing is on a net basis.

The company's credit policy has been liberalized, and many residential deposits refunded. This has further streamlined operating procedure.



SIMPLIFIED CROSS-SECTION OF REDONDO BEACH STEAM STATION

Redondo Beach Steam Station



ARRANGEMENT OF GATES and reversing chamber for periodically changing direction of flow of condenser cooling water

IN PLANNING its new 240,000-kw Redondo Beach steam station, Southern California Edison Co took advantage of standard turbines and boilers. These will enable the plant to be placed in operation sooner than otherwise possible. Redondo is designed and being built by Stone & Webster Engineering Corp in close collaboration with Edison engineers. The plant has many interesting features. One of these is the reversal of flow of the ocean condenser cooling water every 8 hr. This is expected to inhibit marine growths within the two 10-ft concrete conduits that extend out to sea. Another feature is the elimination of auxiliary fuel storage tanks at the boiler plant. Oil will be pumped directly to the burners from the large oil storage tanks located at a distance from the plant. Amplidyne and Rototrol generator field control also is new.

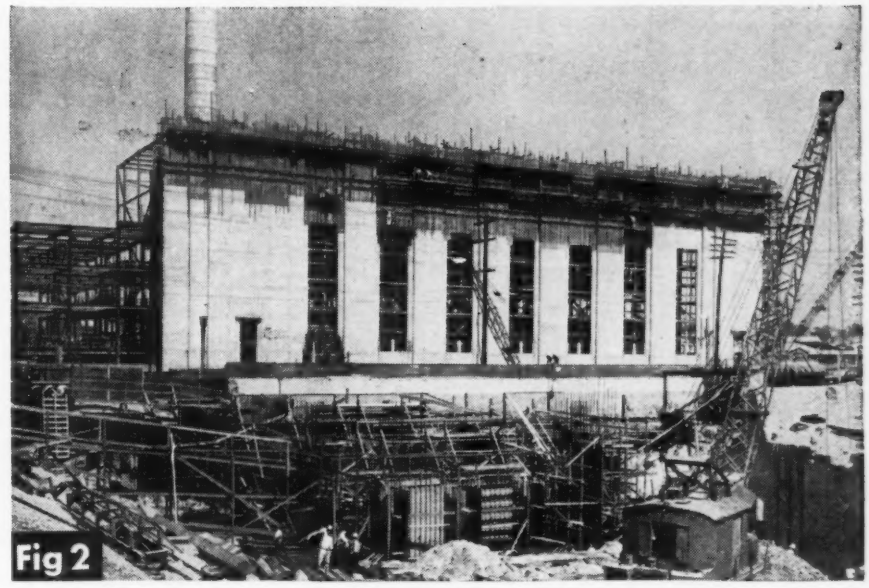
Turbo-generators are standard ASME-AIEE, 60,000-kw machines with slight modifications. Two of four units are now being installed, the others will follow. Boilers are standard steam generators of 400,000-lb-per-hr capacity. Part of a combined steam and hydro system, Redondo is a standby plant designed for 35 percent load factor and quick pick-up of both main and house generators. The 850-psi, 900-deg combination was chosen rather than the 1,250-950, largely because of the quick pick-up requirements. It is expected to pick up 75-80 percent of full load instantly on the main units and reach full load in less than 10 min from minimum load (5-10 Mw). A quick-response house set of 7,500 kw capacity will pick up full load in 15 sec. Normally, station auxiliaries will be supplied through a transformer bank from the main bus.

The plant is designed for low average load factor and quick pick-up. It does not contain some of the features found in the newer base load plants in the East. Anticipated economy is 12,500 Btu per kwhr or 500 kwhr per barrel of oil.

Marine growths, building up in tunnels and conduits, restrict flow. These are always a problem where sea water cooling is used. No undue gamble was taken in providing for reversal of flow every 8 hr. It is felt that bringing cold water in one

Redondo Features

- Standard units and boilers
- Reversal of cooling water to prevent marine growth
- Fuel oil pumped directly from large storage tanks
- One and one-half boiler per unit
- Provision for washing superheaters
- 80% load pickup instantly
- Optimum pressure and temperature for life of plant at design load factor of 35%
- Amplidyne and Rototrol field control of main units for quick response and better voltage regulation
- Inclined insulator posts on 69-kv switches to prevent fog drip from skirt-to-skirt



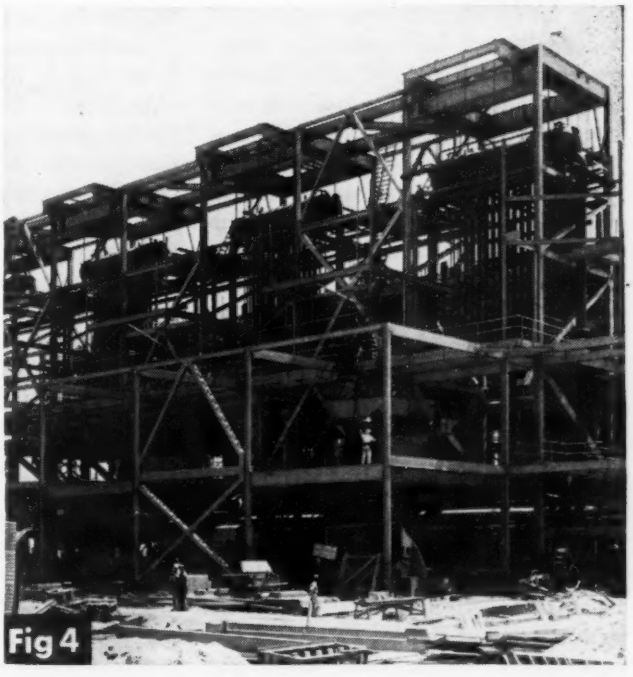
REVERSING BASIN in the foreground is used for changing direction of flow of ocean cooling water to prevent marine growths

Has New Operating Features

conduit and forcing warm water out the other for 8 hr, and then reversing, will practically eliminate these troublesome growths. As a still further remedial measure, the discharge water will be thoroughly chlorinated.

Reversal of flow requires a large concrete chamber containing a system of tanks and gates. See Fig 1 and 2. Waterways for obtaining the 1,300 cfs of cooling water required consist of two 10-ft ID reinforced concrete tubes extending 1,900 ft to sea. See Fig 3. At the outer end they are fanned out to a separation

TWO 10-FT CONCRETE TUBES will extend 1,900 ft out to sea for condenser cooling water



FOUR 400,000-LB BOILERS will supply first two 60,000-kw units. Oil or natural gas will be burned

Fig 5

FUEL OIL will be pumped 800 ft from 100,000 bbl storage tank (in background) directly to burners without the customary intermediate oil storage tanks near boilers

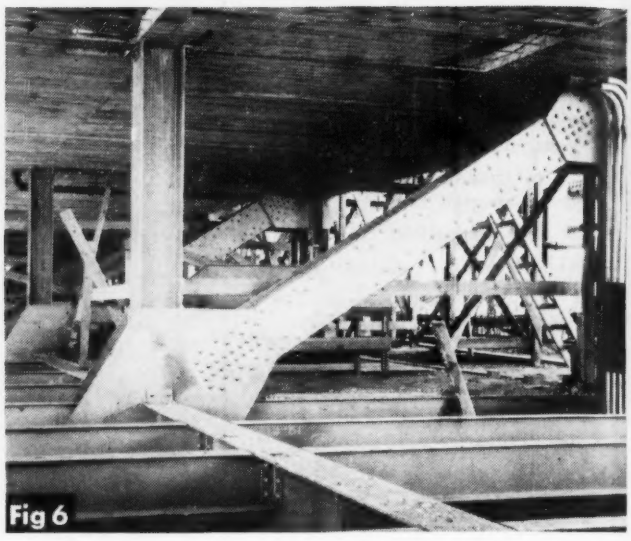


Fig 6

EARTHQUAKE BRACING was provided throughout plant. Turbine-generator units each have separate "floating" foundations independent of plant structure

of 200 ft to prevent the warm water discharged from re-circulating. Intakes will be submerged 25 ft. The 10-ft sections of concrete conduits will be laid and joined in trenches in the ocean floor, then backfilled and covered with 4 ft of sand.

Each turbine-generator unit will require 600,000 lb of steam per hour at full load. Since each of the Babcock & Wilcox boilers selected have a capacity of 400,000 lb per hr, the practice of employing one boiler for each turbine, as a unit, was deviated from. The first two machines will have four boilers and the ultimate of four units will be supplied by seven boilers. See Fig 4. This will make one and one-half boilers per unit with one spare. This is considered good practice in view of the standby nature of the plant and the quick pick-up requirement. A four-stage regenerative feed water heating system will be used because the turbines are standard and provided with five-point bleed.

Oil or natural gas will be used. With some modifications, pulverized coal can also be burned. Oil forms a soot accumulation on the surface of the superheaters. To maintain maximum efficiency, provision was made to wash superheaters with high-pressure water jets directed by hand lances through inspection doors. A drip trough at the lower end of the superheaters catches any water not evaporated and prevents it from getting to the furnace walls. With this arrangement, it is expected that washing can be done with a boiler in service at light load.

To eliminate auxiliary oil tanks and the piping and pumps required, a departure was made in feeding oil to the burners. Oil is taken from two 100,000-bbl storage tanks located some 800 ft from the plant. See Fig 5. The oil is supplied through heaters directly to the burner constant-differential pumps by screw-type pressure pumps at 600 psi.

Operation and instrumentation of the boiler plant will be of the conventional type.

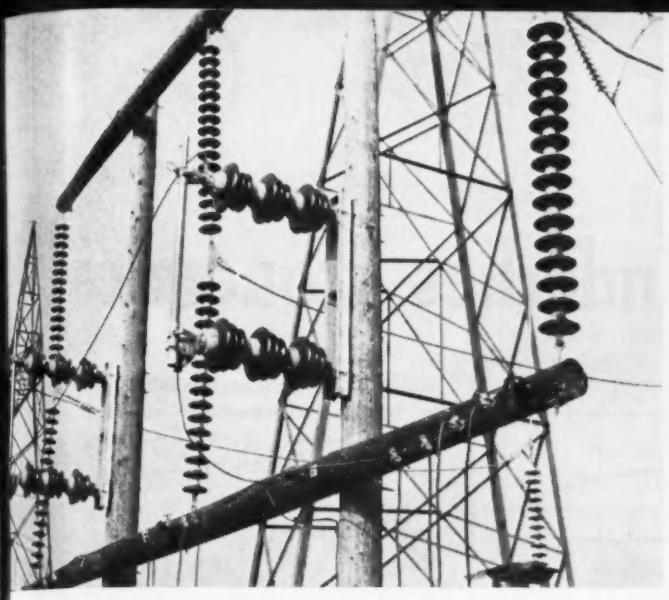
Turbine-generators are 60,000-kw, 3,600-rpm, hydrogen-cooled machines. One of the first two units will be furnished by the General Electric Co, the other by Westinghouse Electric Corp. The 13.8-kv generator leads will run via tunnel to step-up transformers at a switch rack back of the plant. One of the factors that influenced location of the plant was proximity to a major 220-kv substation through which to feed into the system. At Long Beach, generator voltage was stepped up directly to 220 kv. Redondo output will be fed into La Fresa substation, 5 miles away by 66-kv lines. With such short transmission into the system, it was decided to avoid the problems of operating high-voltage equipment at the sea shore, although with fresh water washing while energized and scheduled cleaning, experience at Long Beach has been satisfactory. Based on this Long Beach experience, a modified insulator washing system will be installed at Redondo.

A new design is being tried on the 69-kv disconnects being furnished by Cole Electric Co. Post insulators of the switches will be inclined 15 deg with the vertical. Thus fog condensation drippings from the skirts of the insulators will fall clear of the skirts below. This will maintain insulating value.

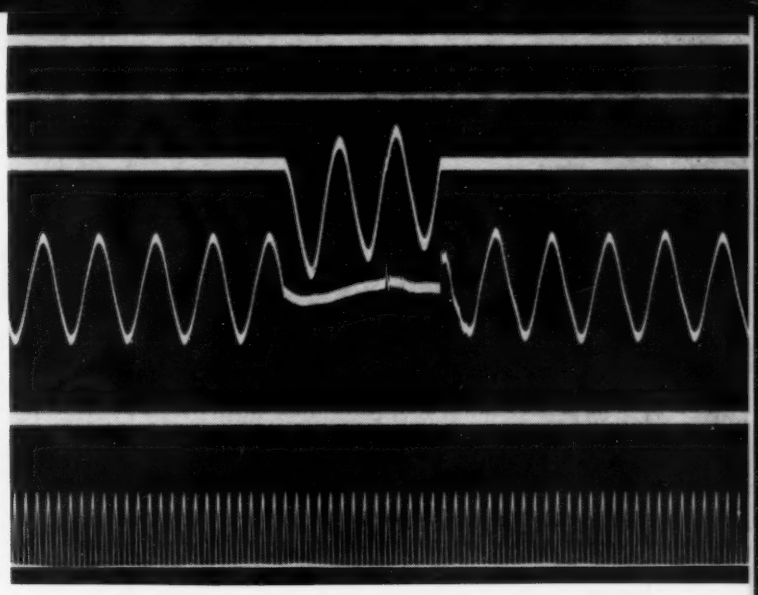
An electrical feature, entirely new to large generators, will be application of General Electric's Amplidyne field control to one of the units and Westinghouse's Rototrol to the other. These will provide high-speed response and better voltage regulation. Southern California Edison has pioneered in this type of field control with two successful applications of the Amplidyne, one to a 50,000-kv synchronous condenser and the other to a 60,000-kva frequency changer set.* Being essentially amplifiers, Amplidyne and Rototrol require only small low-voltage networks and radio type controls. This is a big advantage. In addition, faster response is obtained in case of faults or system changes.

The Redondo plant building is constructed of steel and concrete, heavily braced to resist earthquakes. See Fig 6. Construction of this type is necessary in this location. Operation is expected by February, 1948.

* ELECTRICAL WORLD will subsequently publish an article on these applications.



TWO 115-KV FUSES IN SERIES interrupt 2,300 Mva in 2½ cycles on 230-kv tests



OSCILLOGRAM OF 2,300-MVA TEST showing that fuses interrupted 9,500 rms amperes

Two 115-Kv Fuses Can Open 230 Kv

Successful performance of present fuses at ratings up to 138 kv leads to tests at 230 kv . . . Results indicate that use of fuses can now be extended to the higher system voltages

FUSES of the 138-kv class are being used successfully on the primary side of power and potential transformers fed from high-voltage transmission systems. Their use has been particularly significant where power demand is limited and the cost of primary circuit breakers cannot be justified by switching or relaying requirements. When recent designs are coordinated with the insulation levels and characteristics of modern high-voltage systems, fuses provide high interrupting capacity and dependability. Rapid isolation of short circuits is possible under severe conditions with a minimum of system disturbance.

These advantages and the satisfactory experience with the improved fuses have aroused interest in extending their use to higher voltage levels. Recent field tests on S & C type SMD fuses indicate that such applications are feasible. The tests were conducted over the week-end of February 23, on the 230-kv bus of the J. D. Ross substation at Vancouver, Wash., one of the largest in the world. Facilities were provided by the Bonneville Power Administration in conjunction with tests on a 220-kv, 2,500-Mva, German air blast circuit breaker (ELECTRICAL WORLD, March 1, 1947, page 43).

To match the 230-kv system voltage, two 115-kv fuses, supported in standard 115-kv mountings, were connected in series between one phase and ground on the 230-kv bus. The test arrangement is shown. A 70-mile line was connected to the 230-kv bus during the tests to approach recovery voltage conditions in service. The nominal short-circuit value was varied by including a number of 115/230-kv transformer banks in the test circuit.

Fuses Interrupt 2,300 Mva

Nominal symmetrical short circuit values of 1,800,000 kva and 2,300,000 kva were interrupted by the two fuses in series in 3½ and 2½ cycles. The oscillographic studies of the 2,300,000-kva test indicate that the asymmetrical current reached a value of 9,500 rms amp in the first half cycle. This corresponds to 3,800,000 kva on a 3-phase basis. The SMD fuses, which employ boric acid in an interrupting structure designed to confine the arc within the fuse tube, cleared these short circuit currents with a dull report, exhausting a few feet of arc products and steam.

The tests showed that fuses of this type will clear primary short circuits on 230-kv circuits fast enough to match the three-cycle performance circuit breakers at this voltage level. Speed of clearing was also sufficient to insure minimum system disturbance and maximum system stability. The tests further verified the 8,400-rms amp interrupting rating assigned to 115-kv SMD fuses without condenser on 110-kv systems. In such cases the arcing time and the duty imposed on one fuse is about the same as when two fuses, in series, are used to interrupt a current of the same size on a 230-kv system.

Tests were also made at Ross substation on single 115-kv fuses at the 132-kv phase-to-ground potential of the 230-kv bus. These tests showed that currents within the interrupting rating of a 138-kv fuse can be cleared by a single fuse connected between phase and ground on a 230-kv system. However, a tendency to restrike the arc was disclosed by the oscillograms. This made it obvious that to secure fuse protection for 230-kv service, and particularly to provide a margin of safety with respect to normal frequency and transient recovery voltage, it is necessary either to connect two 115-kv SMD fuses in series or to employ a single fuse possessing a voltage rating matching the system voltages.

Diversity Factor Underlies Economical

H. E. CAMPBELL
Power Distribution Division
General Electric Co
Schenectady

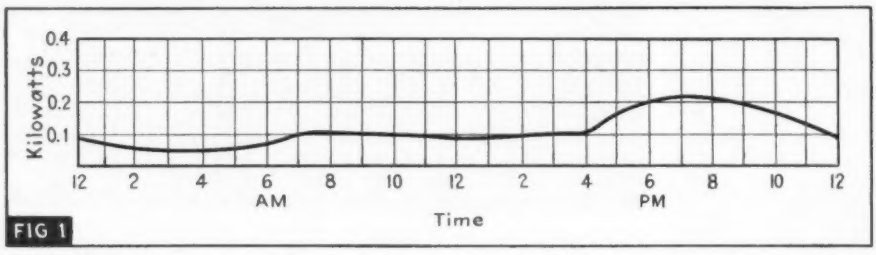


FIG 1

DIVERSIFIED demand of lights, applicances and refrigeration on a per customer basis (80 kwhr per month)

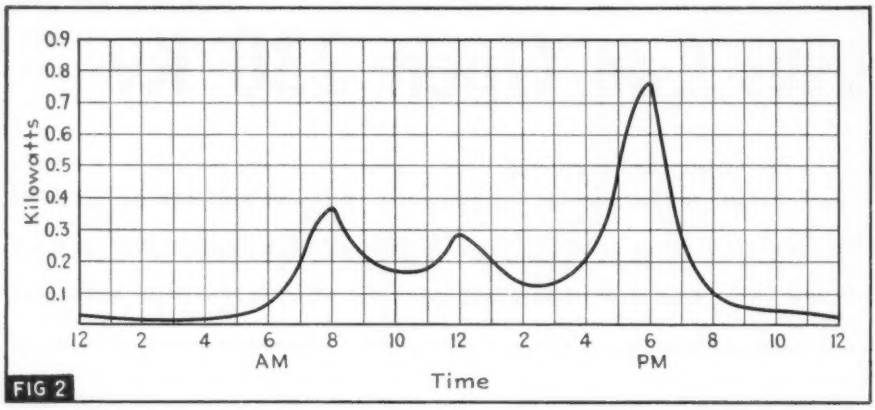


FIG 2

DIVERSIFIED per-customer demand of electric range (normal day, urban condition, 83 kwhr per month)

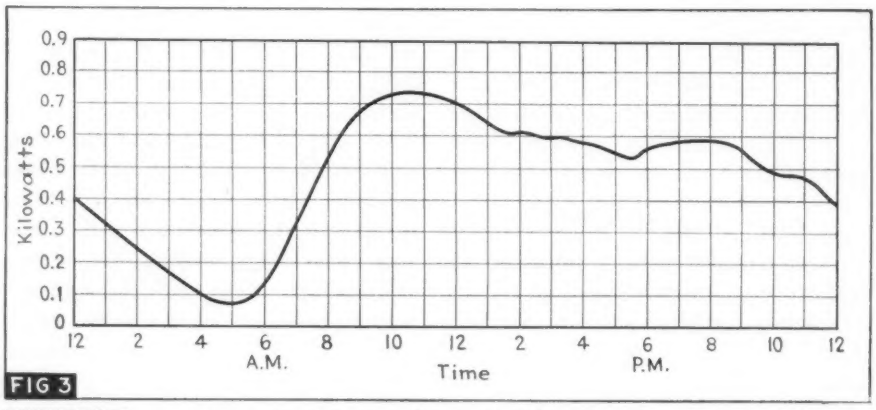


FIG 3

DIVERSIFIED per-customer demand, water heater load (no off-peak control, 340 kwhr per month)

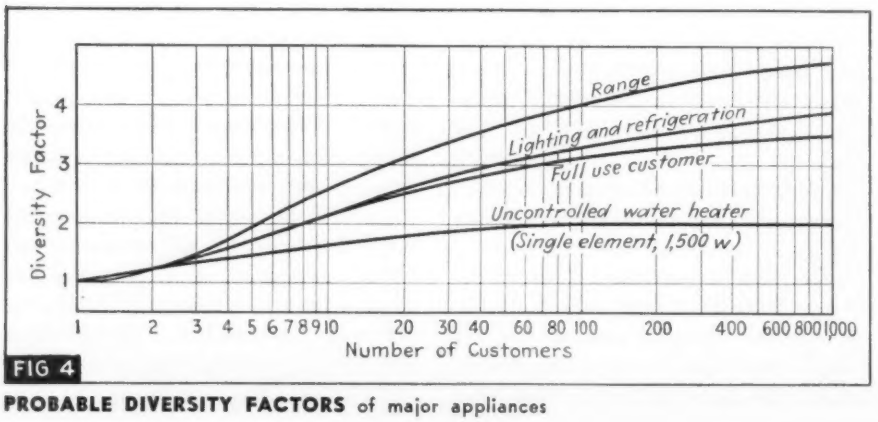


FIG 4

PROBABLE DIVERSITY FACTORS of major appliances

DIVERSITY is a valuable asset to utilities. It is the diversity between loads of individual customers and classes of service and in different areas that permits a utility of relatively small generating capacity to supply loads of much greater aggregate size. This is the reason that it is not most economical to have a system consisting of one class of load. All classes are required, and in the proper proportions, to give the most economical system.

For convenience, diversity of loads has been expressed by a term known as diversity factor. *Diversity factor* is the ratio of the sum of the maximum demands of the component parts of a load to the maximum demand of the load measured at the supply point. It is this factor and its relation to distribution system design which is discussed in this paper.

Loads on a distribution system take on a characteristic depending on the point of the system at which the load is examined. First, there is the load of a particular appliance taken individually. Second, as one moves away from the appliance out onto the system, this load combines with like appliance loads, and although the shape of the load curve is similar to the individual curve, the demands per appliance become smaller because of diversity between the appliances. Third, this appliance load adds to other unlike appliance loads to form what might be called a class load; such as, residential class. And fourth, this class combines with other classes to give a system load. A knowledge of these load characteristics and the diversities between loads and classes should aid in economical distribution system design.

Most difficult of the class load curves to get is the residential. This

Design . . . I

is because the billing is based on the kwhr consumption and no record is kept of demand. Therefore, it has been necessary to make special survey tests to determine the characteristics of this load. The load curves used in this paper are the best available results of such tests. They are used for illustrative purposes only, because it is realized that such curves vary for different utilities due to living habits and geographical location. However, the maximum diversified appliance demands vary with annual consumption, so that any individual can adjust the values shown here to suit his case.

The 1942 Edison Electric Institute report shows that 71 percent of the domestic customers have electric refrigerators and it is reasonable to believe that this percentage will rise fast in the next few years. Therefore, lights, miscellaneous appliances, and refrigerators can be considered as one load for all practical purposes. Such a load curve is shown in Fig 1 for about 1,000 units. Each of these units has a monthly consumption of 80 kwhr.

Range and Water Heater

Next most popular major appliance found in the domestic load is the electric range. This appliance showed a saturation of 12 percent in 1942. Fig 2 shows the shape of this load curve for a normal day of urban use. This curve is the diversified demand of about 1,000 customers where the monthly consumption is approximately 83 kwhr for each of the electric ranges considered.

The electric hot water heater has been the major appliance to follow the electric range in saturation. The same EEI report gives a saturation of 4 percent for all types of water heaters. This daily diversified load curve is shown in Fig 3 for uncontrolled water heaters using 340 kwhr per month. Here again, the curve is for about 1,000 units operating together. This diversified demand curve is about the same for single-element and twin-element tanks and for various sizes of elements of NEMA standard tanks in groups of 1,000 units or more. The demands come very close to being the same at the time of system peak. The difference in demands for various sizes of elements where smaller groups are considered appears in the diversity factor for the heater.

All of the preceding curves are 30-min demands for an average week day during the peak winter season. This winter demand is probably that for which the system must be designed at the present time. If air conditioning or room cooling becomes popular in the home, then this peak might shift to the summer months.

Diversity Factor Variation

Curves shown here are for groups of 1,000 like appliances. It has been shown that the change in diversity factor is small for groups of appliances larger than 100,* therefore it is reasonable to assume that there is no change in diversity factor for groups larger than 1,000. In other words, the curves shown here represent the smallest diversified demand obtainable for grouping like appliances. For smaller number of appliances in a group, numbers below 100, the diversity factor changes rapidly, and the diversified demand per appliance becomes greater. Fig 4 shows the probable diversity factor vs number of customers' curves for the three major appliances separately and combined. The diversified demand per appliance for any number of appliances in a group can be obtained by multiplying the diversified demand as shown for 1,000 units by the ratio of the diversity factor of 1,000 units to the diversity factor of the group in question.

Heater Curve is Flatter

An interesting observation to make here is that the more peaked the daily load curve, the larger the diversity factor. Comparing the water heater curve with the range curve, it will be seen that the water heater daily curve is much flatter than the range, and as would be expected, the diversity factor of the water heater is less than half of the range diversity factor for large groups of various household appliances.

Discussion so far has been concerned with the diversity of like appliances with one another. A residential customer is expected to have one or more of these appliances; so there is the diversity between appliances to consider. Adding together the diversified demand curves for any number of appliances will give the diversified demand curves for the appliances operating together. Quite often, it is convenient to consider a full use customer as one large appliance. Fig 5 shows this daily load curve and its diversity factors are shown in Fig 4.

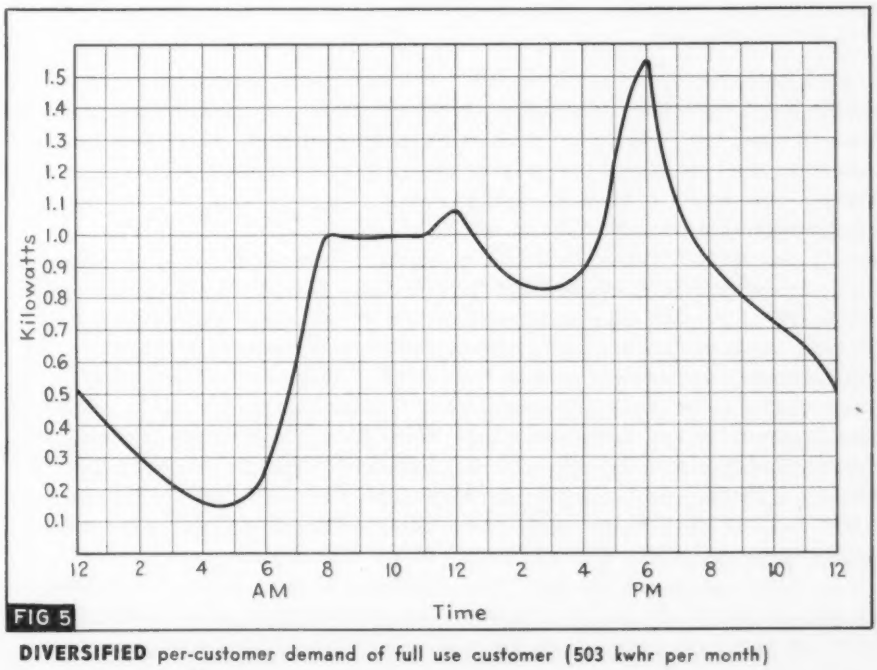
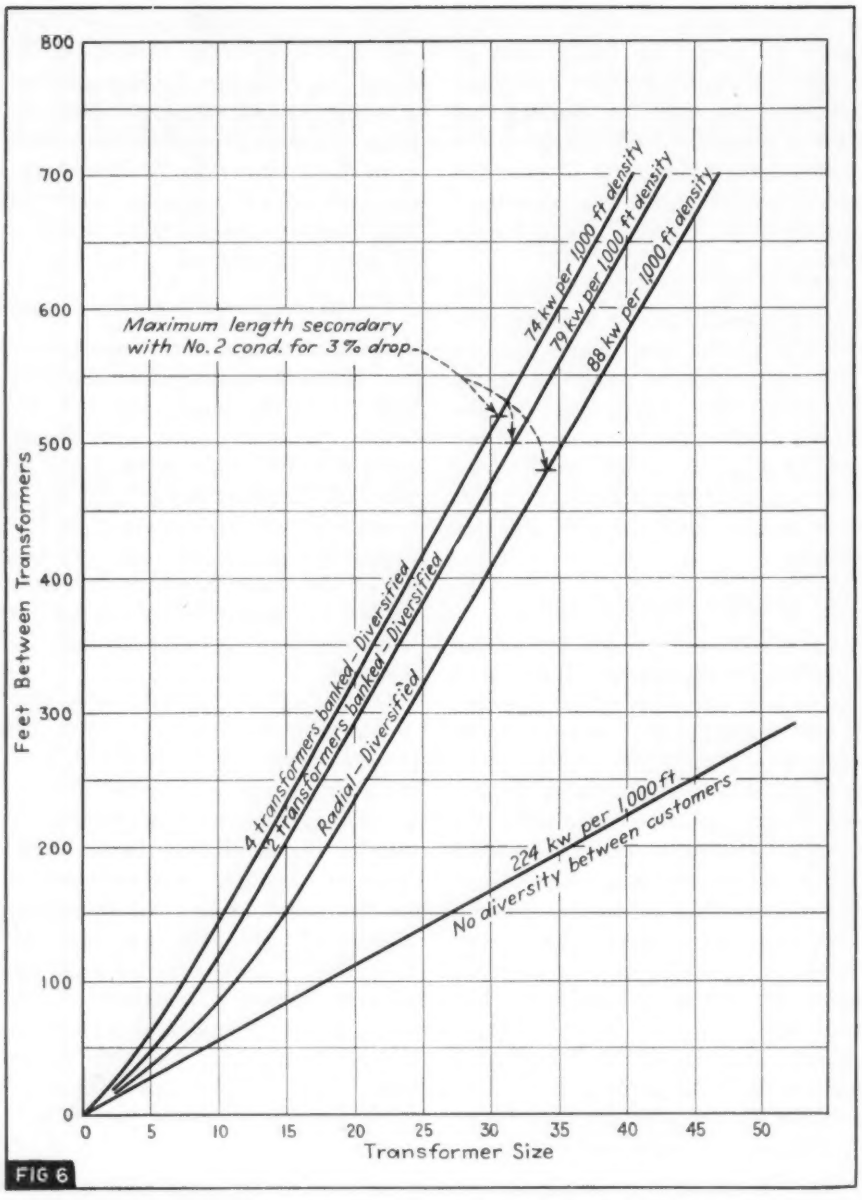


FIG 5

DIVERSIFIED per-customer demand of full use customer (503 kwhr per month)



TRANSFORMER DEMAND variation with radial and banked secondaries (125 percent loading of transformers)

Such information as outlined will enable one to estimate the residential class of load for system study. The one thing that is known about residential customers, or that can easily be determined, is the monthly or annual kwhr consumption. If this annual consumption is approximately 1,000 kwhr or less, it is probable that the customer is one with lights, miscellaneous appliances, and a refrigerator. If the annual consumption is approximately 2,000 kwhr, the customer is likely to be one with a range. Likewise, one using around 6,000 kwhr or more is probably one with a range and water heater. These figures are values for average customers, and they should be satisfactory for classifying customers. Once the classes of customers have been determined, the distribution system can be studies by making use of the preceding diversified demand curves.

Radial vs. Banking

As an example, a knowledge of diversity between appliances can be used to compare the economics of radial and banked secondaries for steady state loads. The advantages of banking to reduce voltage fluctuations during motor starting conditions have been shown many times and will not be discussed here. Assume the pole spacing of a distribution system to be 100 ft with four service connections at each pole. All customers are considered to be full-use customers and the loads diversify in accordance with the several curves shown.

Theoretically, the more customers there are in a group on a secondary feeder, the larger the diversity factor up to about 1,000 customers. This is correct only if the group has one point of supply. In banked secondaries, where there are several supply points, a limit is reached in the diversity between customers, because a load on one end of a long bank will not be supplied by a transformer on the other end of the bank. To avoid this condition, no more than four transformers were banked together for this study.

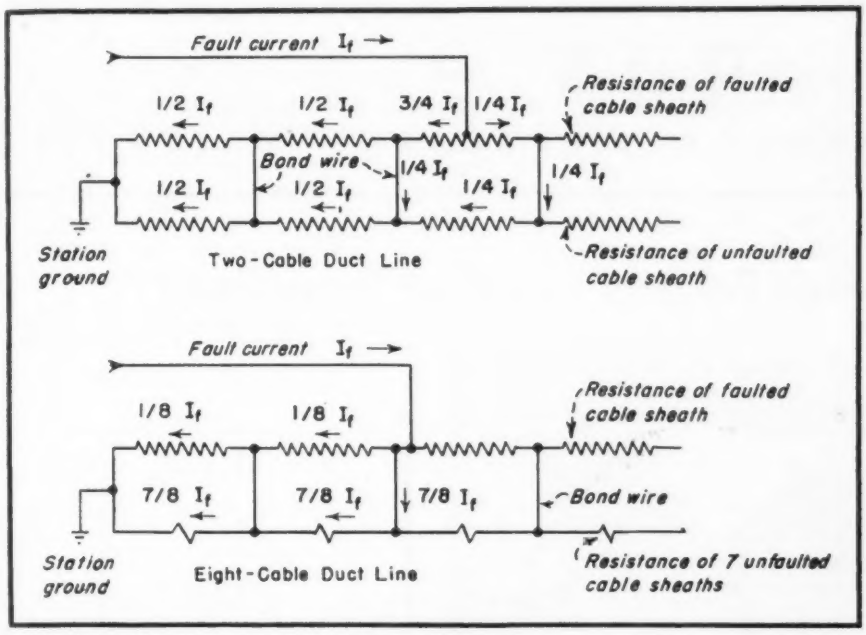
Previous studies† show that with a No. 2 radial conductor, the most economical arrangement would be to have transformers placed about 500 ft apart. Fig 6 shows the relation between transformer capacity and spacing where transformers are allowed to load to 125 percent of rating. The size of transformer for this radial system would be 35.3 kva. Also shown in Fig 6 is the capacity vs spacing relation when two transformers are banked and when four are banked. These curves were derived using the diversities for greater number of customers per group shown in this paper. Hence, with the spacing of transformers the same, it takes capacities of 31.75 kva per transformer and 29.50 kva per transformer for two transformers banked together and four transformers banked, respectively. This is a saving of 10 percent and 16 percent in distribution transformer capacity, which should amount to about the same reduction in secondary distribution investment.

The secondary distribution system investment is approximately 23 percent of the total system investment to supply this class of load. Banking should, therefore, allow a reduction of this total system investment of 2.3 to 3.7 percent. This could amount to something of the order of $130,000 for a utility with 25,000 residential customers.

The ensuing instalment will build up the total system load by introducing comparable load curves for the retail-power-light, large commercial, and industrial loads.

* "Coincidence-Factor Relationships of Electric Service Load Characteristics," by Mr. Constantine Bary, AIEE Technical Paper 45-116.

† "A Study to Determine the Most Economical Size of Copper Wire for Secondary Conductors in Overhead Distribution Circuits," by Mr. W. J. McLachlan, General Electric Co.



DISTRIBUTION OF TYPICAL FAULT CURRENTS between faulted and unfaulted cable sheaths in 2-cable and 8-cable duct lines

Protecting Cable Sheaths

H. R. STEWART
Protection Engineer
New England Power System,
Boston, Mass.

IT IS universal practice to bond cable sheaths in duct lines carrying more than one cable. There are several probable reasons:

1. Protection of men working in manholes from possible differences in sheath potential due to a cable sheath failure.

2. Prevention of electrolysis troubles due to direct current flowing from one sheath to another in paths other than the bonds. It also facilitates electrolysis control between the cable system and other underground structures.

3. Insures more adequate relay tripping current which otherwise might be limited due to the resistance of the single-sheath return.

4. Reduces sheath burning caused by arcing from a faulted cable's sheath to others in the same duct line.

5. Reduces the danger of long sheaths due to melting the flow of high fault current in the single sheath.

From a paper presented before the Underground Distibution Engineers of New England.

The question arises, "How large should cable sheath bond wires be in manholes?" Bond wires on a faulted cable sheath in two manholes on either side of a fault may have to carry from 25 to 100 percent of the total fault current. The amount depends on whether the fault is midway between manholes in a 2-cable line with single end feed, or close to a manhole in a multi-cable line with single or double-end feed. The diagram supports these statements. Four kv systems, in which the ground fault current for a fault near a station may reach 30,000 to 40,000 amp are fairly common. This calls for bond wires of 250,000 to 350,000 cir mils in order to last the 2 sec required for back-up relays to trip. However, the largest sheath commonly used on a 500,000-cir mil, 23-kv, 3-conductor cable will itself melt in 2 sec. when carrying only 11,000 amp. Thus No. 1/0 bond wire is the maximum size required from the practical standpoint. However, if two bond frames are used per manhole, or if the bond wire is looped from sheath to bond frame No. 3 copper is large enough.

On systems above 4 kv the neutral is likely to be grounded through resistance or reactance. This limits the ground fault current to 5,000 amp or less even for faults close to the station where the neutral is grounded. Here smaller bond wires can be used than the sizes required to balance the melting characteristics of the sheath itself. Then the following relations hold:

	← Bond Wire Sizes →	
Ground Fault Amp	One per Manhole	Two per Manhole
5,000	No. 3	No. 6
2,500	No. 6	No. 9

As the fault moves away from the station, the current gets smaller. Theoretically this permits smaller bond wires. But as a practical matter the same size would probably be used throughout to prevent errors. When cables of different voltages are in the same duct line, the bond wire sizes should correspond to the heaviest fault current any one of the systems can deliver.

For somewhat different reasons, sheaths where cables enter station structures should be bonded to the structure. If the cable rises vertically from the fiber duct to a pothead bolted to the station steel, there seems no reason to bond the sheath to the station steel. In such a case there is little likelihood that arcing, which may develop at the pothead mounting bolts during the flow of heavy ground current, will damage the sheaths. But if such a cable is trained in a metal trough or contacts the station steel, the sheath should be bonded to the trough. This will bypass any poor contact between the pothead body and the steel on which it is mounted, thus avoiding a tendency for fault current to pass from the sheath to the trough. Such a bond wire may have to carry the full ground fault current. Hence a No. 1/0 bond wire should be used if the ground fault is 11,000 amp or greater.

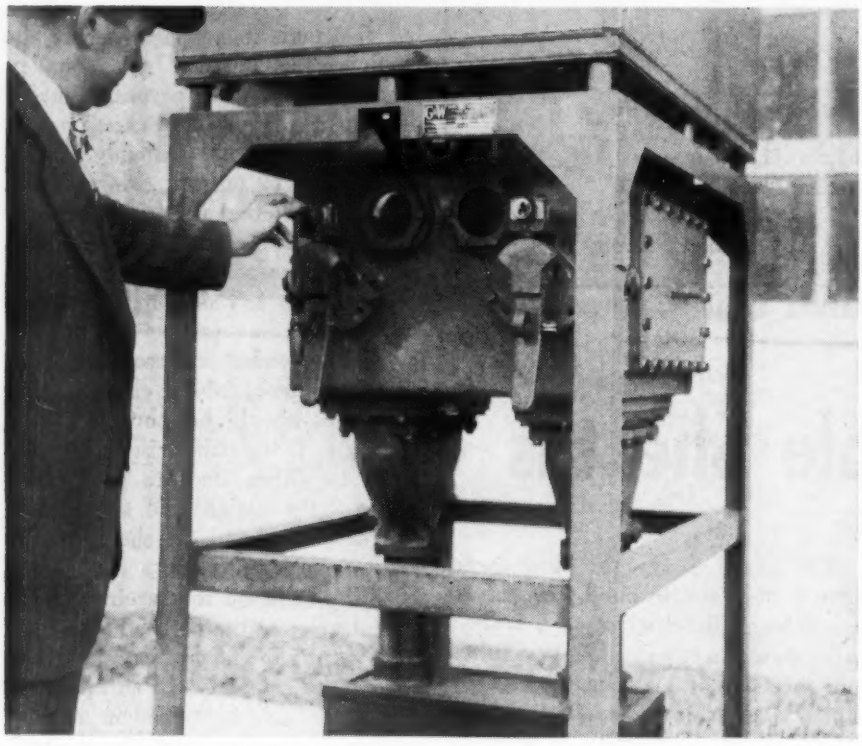
Where lightning cannot contact the conductor of metallic sheath cables, they are virtually immune to lightning troubles, even for direct strokes on aerial sheaths. But if lightning can contact the conductors, they may need lightning protection, not only for themselves, but for apparatus to which they may lead the lightning surge. It depends on the length of the cable.

An arrester is most effective when connected from conductor to sheath and to ground by the shortest possible leads.

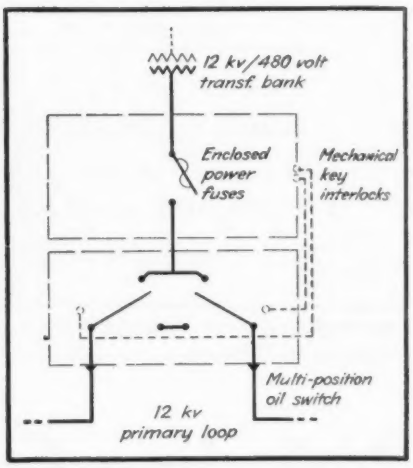
HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

5-Way Oil Switch Permits Low-Cost Loop Feed



TWO-KEY INTERLOCK prevents opening high-tension fuse cabinet (above) until oil switches are in proper position to kill tap to fuses. Both keys shown are required to unlock fuse cabinet door (not shown). Portholes permit inspection of switch position



CONNECTIONS of combined multi-position oil switch and high interrupting capacity fuse unit that provide economical and flexible means of feeding transformer stations from 12-kv loop

O. O. RANDS
Electrical Engineer
12th Naval District, San Francisco

THE PROBLEM of providing a high degree of continuity of service to the Navy's California Moffatt Field aircraft maintenance shops was satisfactorily solved by the multi-position oil switch and load interrupter fuse unit illustrated. Power supply consists of a 12-kv underground cable loop, to which is connected two 600-kva and one 750-kva, 12,000/480-volt transformer substations.

It is possible to operate each station under any of the following conditions: 1. Loop closed with station connected; 2. loop closed with station disconnected; 3, station fed from either side of the loop with the other side grounded or open; and 4, with the station disconnected and the loop either open or grounded.

To accomplish this the multi-position G & W oil switch shown was used. Since this device only performs switching functions, transformer protection was provided with S & C load interrupter fuses mounted in a steel cabinet above the oil switch. Safety features incorporated in this unit include key interlock devices installed on the operating handles of the oil switch and the door of the fuse cabinet. The two keys from the handles of the switch cannot be removed until the switch is in the position to isolate the fuses. Both of the keys are required to open the fuse cabinet door (on the face to the left on the square cabinet).

Circular glass portholes, as shown, are provided so that the actual position of the links inside the switch can be observed before working on the switch-fuse unit.

On relatively small transformer stations supplied from 12-kv circuits, where the cost of oil circuit breaker equipment would exceed the cost of the equipment to be protected, the method described proved an economical and satisfactory solution to the problem.

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How to Inspect Junction Boxes

FROM the operating practices of an eastern power system are taken the following condensed routines of junction box inspection, annually required on a-c circuits:

Before work begins on catchbox inspection of bus or terminal lugs, a rubber shield is placed between the side of the box and the bus on which the work is to be done. All missing or broken studs and nuts are replaced.

Loose studs are removed and coated with iron cement and tightened in place after the stud hole is cleaned. Oil is applied to studs before replacing holding nuts. Inside cover cracks require immediate replacement, and insulating material on the under side of a cover is protected and replaced when necessary. If threads are damaged on brass lifting hole bushings, replacement follows. Notes are made of any box found with elongated drain holes blocked with dirt or cement.

Gaskets are not allowed to remain in service until broken or ragged but are replaced as soon as the rubber has lost its life and resiliency. Flake graphite is applied to the gasket seat on the under side of the cover after cleaning. Grease may not be applied to covers when boxes are provided with elongated drain holes. Grease inside boxes is cleaned out, rusty sides being painted with black varnish. Bent and broken catches are replaced. Catches and buses are cleaned with No. 0 emery cloth and all bolts tightened. Pressure wires, if any, are taped if bare beyond terminal lugs, replacing wires if insulation is poor, and checking corrosion entrance if present. Repair crews replace pressure wire blocks, when broken or corroded. Poorly soldered or loose lugs are repaired and abnormal conditions reported.

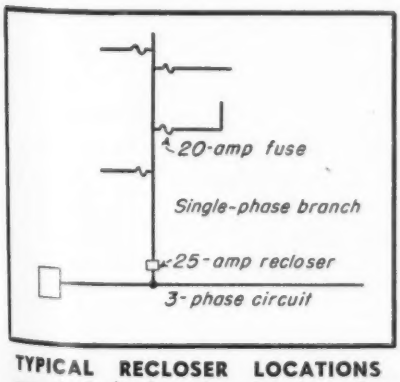
• • •

Apply Line Reclosers to Cut Costs

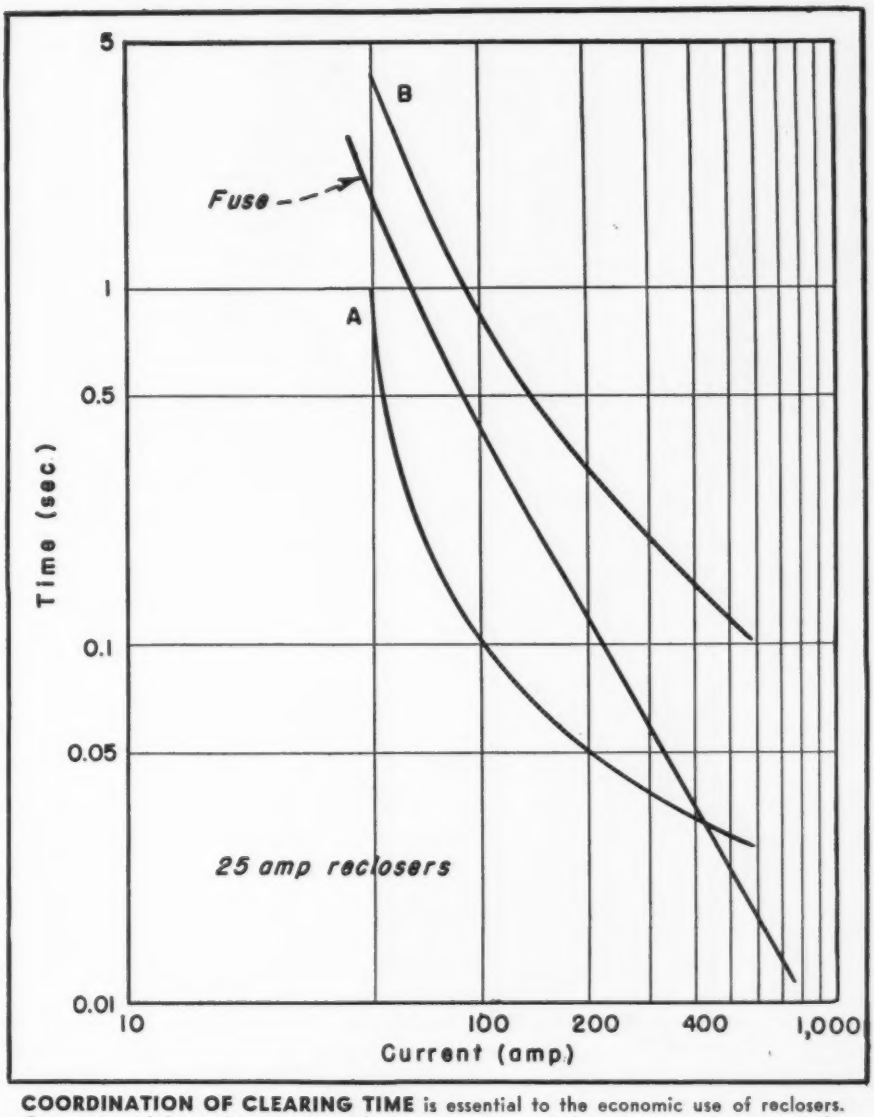
J. B. HENDRICKS
Electrical Engineer
Wisconsin Gas & Electric Co
Racine, Wis.

RECLOSERS on rural lines have the important advantage, compared to fuses, of reducing customer outage time. They can also be justified on a strictly economic comparison basis, as evidenced by a two-year record maintained for nine installations by the Wisconsin Gas & Electric Co system. These locations were included in an extensive program of changing from two- and three-shot fuses, and were selected because of a difficult tree and line operating record. The changes resulted in reduced operating costs and improved outage records.

The accompanying tabulation summarizes one year of operation with three-shot fuses during 1945, and an equivalent period with reclosers in 1946. Columns have been added for service costs and customer outage time. The troubleman trip for each lockout is charged at $3 and lost revenue is charged at 1 cent per customer hour outage. Fuses are charged at 40 cents each.



TYPICAL RECLOSER LOCATIONS are at single-phase branches from the main feeder and single-shot fuses are used for the shorter taps



COORDINATION OF CLEARING TIME is essential to the economic use of reclosers. Curves A and B are for initial and lockout operation of the 25-amp reclosers and the center curve is for 20-amp fuse links

A total service cost of $44.56 is shown for the reclosers. This is an average of $4.97 per recloser per year. Allowing an additional charge of $9 per recloser per year to cover the fixed charge on additional cost of

TYPE "439" OIL-BLAST

WITH SIMPLIFIED

TYPE FK-439 OIL-BLAST BREAKER
Interrupting time 3 or 5 cycles . . . 20-cycle reclosing...Interrupting ratings up to 3500 mva...Voltage ratings 115 to 230 kv

BREAKERS INTERRUPTERS...

EASILY REMOVABLE FOR REDUCED MAINTENANCE

Improved, simplified construction of the new multibreak interrupters on the G-E type FK-439 breakers assures faster circuit interruption for greater system stability. Interrupting time of either 3 or 5 cycles (with 20-cycle reclosing) is obtained on all ratings and has been thoroughly proved by extensive field tests. With the new interrupter you get . . .

REDUCED MAINTENANCE

Long contact life because of arc-resisting materials . . . Ready access to the interrupters is provided by a larger manhole . . . Step rings inside the tank afford the operator secure footing.

QUICK INSPECTION

The entire interrupter is easily taken out, or the 17 lb contact element can be quickly removed for inspection. (Three-step disassembly at right.)

NEW DESIGN FEATURES

Lighter weight of the interrupter plus greater mechanical strength assures consistent performance under all operating conditions . . . A compact, built-in resistor eliminates destructive over-voltages . . . Shorter arc lengths and lower pressures mean greater margins for satisfactory performance.

OTHER "439" ADVANTAGES

The FK-439 breaker also has completely sealed bushings which further reduce maintenance. High-speed reclosing is accomplished by the positive action of the pneumatic mechanism, while redesign has decreased the tank dimensions and overall unit weight. Your G-E sales representative has additional information on the "439" breaker, or write for bulletin GEA-4407. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

First—Static shield is removed.

Second—Studs holding the removable contacts in position are taken out.

Third—Removable contact element is easily withdrawn for inspection.

GENERAL ELECTRIC

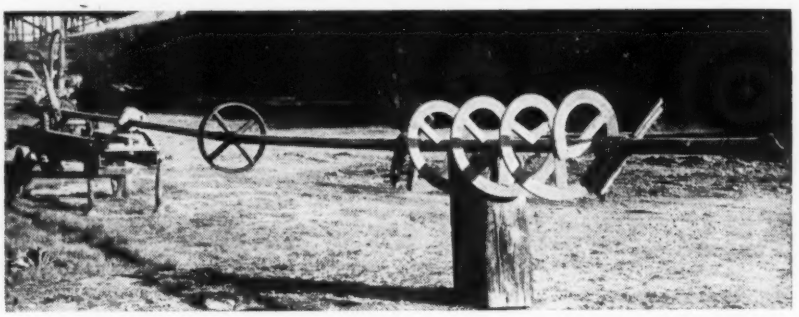
859-7

the recloser results in $13.97 being added annually to the cost of reclosers. On this basis, the company has changed, or plans to change, from a fuse installation to a recloser installation at any location where the cost of servicing with fuses has been $15 per year or more. A survey of operating records indicates that about one-third of the original fuse installations on the system should be changed to reclosers on this comparison.

A typical installation is shown in the accompanying diagram. Reclosers are located at the single-phase taps from the main three-phase circuits. Branch lines can have as much as 15 miles of feeder, including several shorter taps which are fused at the point of leaving the main branch. The system is operated at 4,800/8,300 with neutral multi-grounded.

Proper coordination of fuses and reclosers is essential to economic operation. It has been found that Kyle 25-amp reclosers and standard 20-amp fuse links in the outer taps give the proper combination, as indicated in the section of clearing time-current curves. Curve A is for the first two openings of the recloser. The fuse link then has time to blow if the fault is on a fused tap and remains. Curve B is for the lockout of the recloser with persistent faults on the main branch.

For Straighter Holes



UTILITIES OCCASIONALLY HAVE NEED for driving large holes for underground pipes, using a device of the hydrauger type. Sometimes trouble is experienced in using this tool on long bores in keeping the hole from drifting off-direction due to sag or whipping in the shaft that drives the auger. Such trouble has been overcome by Don Martello of Pacific Gas and Electric Co, by use of the centering wheel shown. The stem of the auger is made in 4-ft lengths, threaded at each end. The wheel with threaded hub is inserted in the stem every 8 ft so that it revolves and travels along with the auger, acting as a centering device. This is in use in the company's Sacramento division

• • •

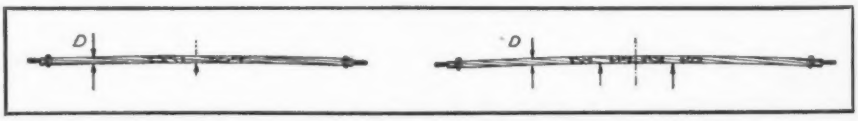
Installation Data for Armor Rods on ACSR

TABULATED DETAILS on the use of straight armor rods on ACSR conductors subject to vibration damage at all supports except deadends. These data are adapted from rural distribution standards of the Tennessee Valley Power Distributors Association, Chattanooga, Tenn.

Notes:

1. For installing straight armor rods, the first setting of the wrenches should be made approximately one-third armor rod length from each end. With this setting, twist the central one-third length as snugly as possible. Then move wrenches to the end positions and twist the remainder of the length of the rods. The lay of the rods should in all cases be in the same direction as the outside layer of strands. Size of wrench frame and catalog number of die should be specified when ordering.

2. Two clips required per set of rods. Both nuts of clips should be turned down the same amount to prevent nuts from working loose.



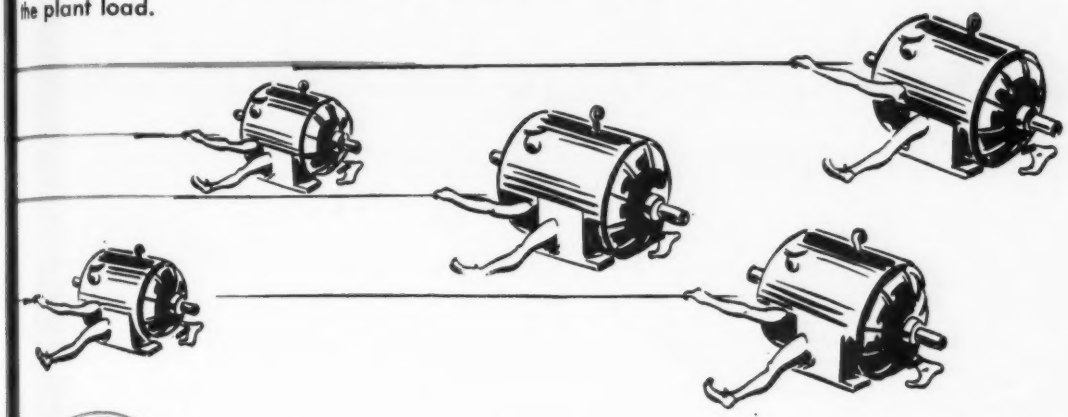
ARMOR RODS applied for single support (left) and double support (right) as indicated by arrows

Details of Armor Rod Installations for ACSR

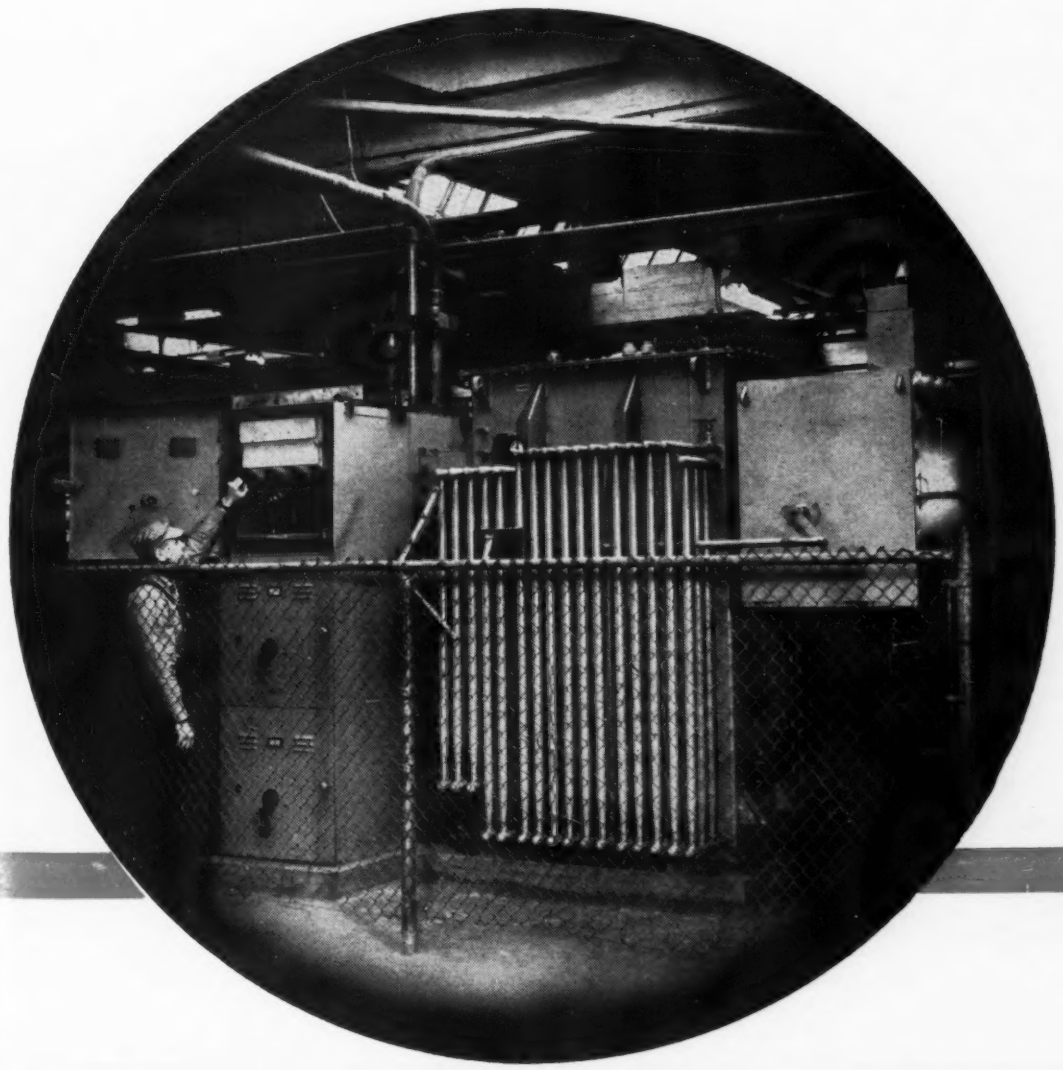
Cable Size	Armor Rods: Alcoa Cat. No. Per Set	Dim. in Inches: Diam.	Length	"D" Dim.	No. Per Set	Wt., Lb Per Set	Armor Rod Clips Alcoa Cat. No.	Wrench Req'd: Frame Size	Die Alcoa Cat. No
Straight Armor Rods for Single Support									
6	1122	0.118	35	0.434	8	0.30	1102	E	*
4	1124	0.149	40	0.548	8	0.54	1103	E	*
2	1126	0.135	45	0.586	10	0.63	1103	D	*
1/0	1128.1	0.173	50	0.744	10	1.14	1105	D	*
2/0	1129.1	0.194	55	0.835	10	1.59	1106	C	4207
Straight Armor Rods for Double Support									
6	1152	0.118	47	0.434	8	0.40	1102	E	*
4	1154	0.149	52	0.548	8	0.71	1103	E	*
2	1156	0.135	57	0.586	10	0.80	1103	D	*
1/0	1158.1	0.173	66	0.744	10	1.51	1105	D	*
2/0	1159.1	0.194	71	0.835	10	2.04	1106	C	4207

*These wrench sizes have integral dies.

The secondary circuits were badly overloaded in the plant of the Union Wire Rope Corporation, Kansas City, Mo. Voltage drops were severe—and costly. What's more, the fast-growing plant needed new equipment that was soon to add 600 HP to the plant load.



GE Load-center Unit!



How to Maintain Temperature Indicators For Generators and Large Transformers

A-C TEMPERATURE INDICATORS—VI*

W. F. DUNKLE
Supervisor of Electric Tests
Pennsylvania Power & Light Co
Hazleton, Pa.

A TESTING and maintenance procedure for an a-c operated temperature indicator and accessories manufactured by General Electric Co.

1. Operation. These instruments, which operate on the single-phase wattmeter principle, are used with a bridge circuit and are specially calibrated to indicate degrees Centigrade. The combination of instrument coils and bridge circuit is such that the instrument reads the change of resistance of a 7.75-ohm exploring coil either embedded in the equipment insulation or immersed in the oil near the top of the transformer. The 7.75-ohm value of this coil is checked at 25 C.

2. Accuracy. Temperature instruments are designed for greatest accuracy at the danger temperatures of 80 C and above. An embedded or immersed exploring coil is by AIEE standards 10 deg cooler than the "hottest spot" temperature. At 80 C and above, good instruments will indicate correctly within a few degrees of the actual coil temperature when they and their accessory equipment are adequately maintained.

3. Precautions. Conductor size, connections, resistance and impedance values of the various branches of the temperature indicator circuit are of importance in securing correct temperature observations. A deviation of more than 2 percent from the basic resistance or impedance data given by the manufacturer shall be reported to the supervisor's office.

4. Testing Procedure. The impedance and resistance values of all new installations should be measured and the values checked against the manufacturers' specifications so that they can be used as a base for future references.

The impedance of the temperature circuit as measured through the 44-v side of the 44/11-v transformer is 108 ohms when the temperature of the exploring coil is 25 C. Between 25 and 85 C, the impedance varies 0.367 ohms per degree change in the exploring coil. Thus for a temperature above 25 C and below 85 C the temperature of the winding above 25 C is equal to the measured impedance (Z) minus 108 and this result, divided by 0.367; or

$$\text{Temp deg C} = \frac{Z - 108}{0.367} + 25.$$

Measure accurately the value of all lead resistance to and from the 44/11-v transformer including that of the 44-v winding. The transformer resistance is 1.9 ohms at 25 C so that the two-way lead resistance is equal to the total measured resistance minus the transformer resistance (1.9 ohms corrected for temperature at time of test) or Lead Res. = measured R — 1.9 (corrected). The compensating resistance should then be set so that when its value is added to the lead resistance the total value is 1.5 ohms.

The operating transformer should also be checked so that with 220-v output the tapped winding should give 176 and 44 v respectively.

5. Instrument Test—Full Scale

(a) Remove wire A to the transformer from the transfer switch in rear of switchboard; refer to diagram.

(b) Substitute the standard 44/11-v transformer and its variable resistor.

(c) Place jumper around compensating resistance. This is 1.5-ohm resistor mounted near 44/11-v transformer.

(d) Place voltage adjusting switch on position corresponding to incoming voltage.

(e) Turn transfer switch so as to select circuit in which standard transformer and resistor have been placed. Vary tapped resistor for 7.60, 8.2, 8.8, 9.41, 10.0 and 10.61 ohms, thus checking instrument at 20, 40, 60, 80, 100 and 120 C.

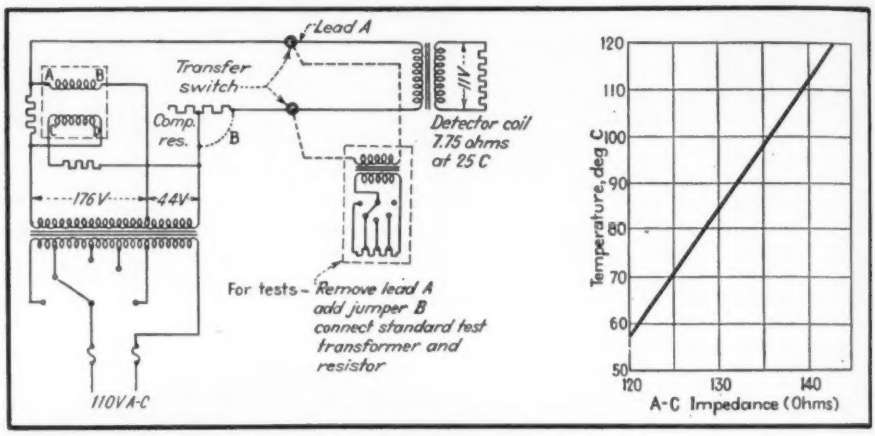
6. Single Point Test at Operating Temperature Over-all Impedance Test

(a) Measure accurately the (over-all) 60-cycle impedance of the 44/11-v transformer resistor combination. Refer to the diagram. This can be done at the back of the switchboard if the 44-v leads to and from the transformer are known to be in good condition. Oil or moisture soaked leads will cause lower impedance readings. Correction must be made to the ammeter reading for current drawn by the voltmeter coil. Correct for true impedance (Z) by measuring and subtracting directly the resistance drop in the leads.

(b) Calculate the corresponding temperatures as follows:

$$\text{Coil temp} = \frac{Z - 108}{0.367} + 25\ \text{C}$$

7. Instrument Adjustments. Adjustments are essentially the same for a-c as d-c instruments. The resistor which determines the accuracy at the balance (off-voltage) point is connected in the bridge circuit between the 176-v transformer tap and stud A of the temperature indicator.



TEST CONNECTIONS for a-c operated temperature indicator

* Concluding a series of articles which began in ELECTRICAL WORLD, July 19, 1947, page 106; an adaptation from a paper presented at a Doble Clients Conference.

are back on the air!

...another powerful promotion that will help to fill empty sockets

REACHES HUGE AUDIENCE OVER 166 ABC STATIONS

Heard the latest in radio? General Electric now sponsors "The Tales of Willie Piper" every Thursday at 9 P.M., EST, over a coast-to-coast American Broadcasting Co. network of 166 stations—bringing G-E Lamp advertising messages to millions of families. It's the newest voice of the best-known name in lamps.

THIS FRIENDLY COMEDY MAKES PEOPLE "LIGHT CONSCIOUS"

"The Tales of Willie Piper" is a happy half-hour drama that's heart warming, human and filled with chuckles. Each Thursday evening show tells the story of typically American events in the lives of young Willie Piper, his wife Martha, his meddlesome father-in-law Mr. Gillespie, and other small town folk who make up the cast. It combines good family entertainment with plenty of reminders to fill empty sockets with right-size G-E lamps!

HOW G-E LAMP RADIO ADVERTISING HELPS TO BUILD YOUR PROFIT LOAD

Many of the commercials on the new G-E Lamp radio show use hilarious bulbsnatching incidents to dramatize the importance of keeping spare G-E lamp bulbs on hand to replace burnouts.

And others are used to stimulate popular interest in the wider use of General Electric lamps for all purposes —lamps for lighting, sunlamps, heat lamps, germicidal lamps. So every week "The Tales of Willie Piper" makes more friends for G-E Lamps—more friends for the electrical industry.

G-E LAMPS

GENERAL ELECTRIC

METER-MOUNTING ARM and convenient controls are featured on this meter test desk

Adapt Standard Desk for Meter Test

J. S. LINEBACK
Supt Electric Meter Dept
Cincinnati Gas & Electric Co
Cincinnati, Ohio

A STANDARD 5-ft steel desk has been altered to meet design requirements of a complete watthour meter test desk in the Cincinnati Gas & Electric Co. All auxiliary equipment is built into the desk so that it is portable to any location where electric service and a compressed air line are available. Potential transformer, loading transformer and resistance load bank are enclosed within the desk, accessible through doors on the back.

All controls and instruments are supported on a steel panel set at an angle convenient to the tester's view and reach. This panel is recessed in a section added to the desk to enclose switches and wiring. The test standard, highly illuminated but without glare, is seen by the tester at convenient eye level by means of an inclined mirror which is visible through the viewing aperture. Reset of the standard is by means of a push-knob located in the front of the desk.

A meter mounting arm is designed to permit movement of the meter to face in any direction and at a wide range of positions in front of the tester. A fluorescent lighting unit mounted on an adjustable arm provides illumination of the meter from any desired angle.

The panel has a black satin finish, the desk top is green battleship linoleum, and the trim is chromium. At any time revision of the desk is desired, the present panel can be removed and a new panel with its revised equipment can be inserted. The desk can be adapted to any testing equipment, such as, for example, relay testing.

Once connected up, all the tests, such as series-element, single-element, and balance of elements, at 0.5 lag, unity and 0.5 lead power factor, at any value of current, at any voltage, can be made by rotary selector switches. Voltage and current values are always indicated on one instrument for each. The proper range is automatically selected. The coil of the test standard most suitable for the load is automatically brought into circuit when operating the load switches.

Load selection of any desired values of current can be made by flipping the required marked toggle switches. Vernier adjustment of any values of current selected can be made by means of rheostats provided.

The circuit is foolproof so that no matter what the condition of the watthour meter connected or regardless of the error in setting that the operator might make, no damage can result to the test desk. This requirement was specified as a "must" in design of the circuit.

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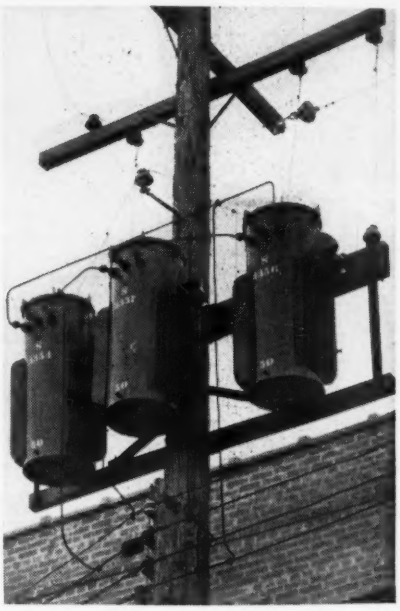
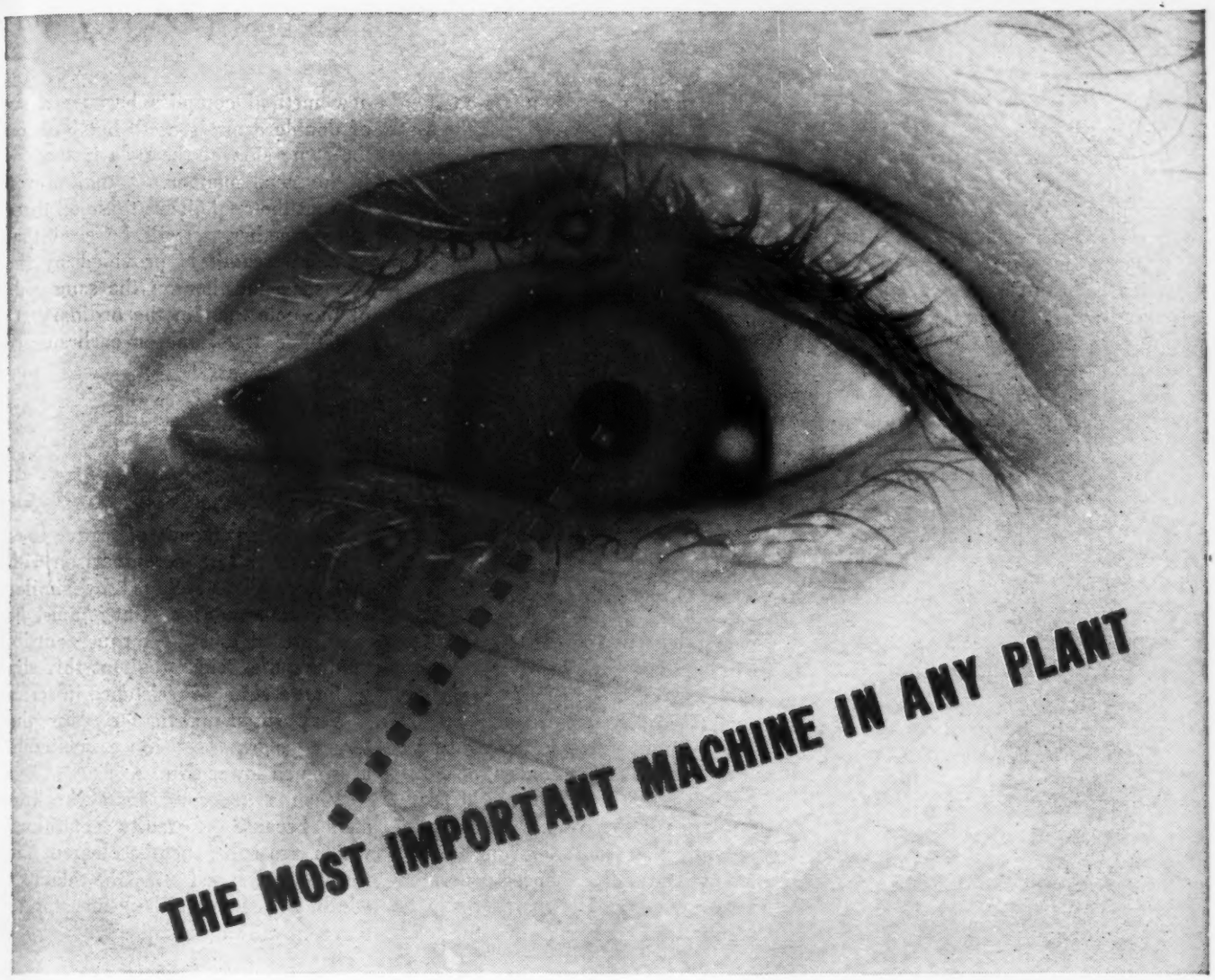
How to Mount 3–50-Kva Transformers on One Pole



MOUNTING of three transformers that costs less and gives better weight distribution on pole than other methods

L. G. FANNING
Washington Water Power Co
Spokane, Wash.

BREAKING AWAY from convention, the Washington Water Power Co has devised a new method of mounting three 50-kva transformers on a single pole. The usual two sets of double arms have been replaced with two single arms one above the other on the same side of the pole with a single kicker arm below. Angle irons at the ends tie the three arms together. Two of the transformers are supported by hangers on the *back* of the



No matter what the process or the product being manufactured, there's one "machine" in every plant that's more important than any other...

THE HUMAN SEEING MACHINE!

No one knows this better than the Illuminating Engineer and the lighting fixture manufacturer. And no one knows better, either, how important *good lighting* is to quick, easy, accurate seeing.

But don't forget that even the finest lighting system can't do an efficient, economical job unless it is backed up by ceilings and walls which reflect a maximum of the light emitted and help distribute it evenly throughout the working area. That means WHITE paint—for white reflects far more light (80-90%) than any other color under both incandescent and fluorescent illumination.

For nearly half a century BARRELED SUNLIGHT has consistently supported the lighting industry in its job of providing better light for better sight. For further data on how white paint can help make good lighting even better, send for a free copy of our 32-page booklet, "Light and Color in the Work-World." Just fill out and mail the coupon TODAY.

U. S. GUTTA PERCHA PAINT COMPANY
14-I Dudley Street, Providence 1, R. I.

I'd like to know more about the partnership of Light and Paint. Please send me your free 32-page booklet, "Light and Color in the Work-World."

COMPANY .....

STREET AND NUMBER .....

CITY ..... ZONE ..... STATE .....

MY NAME IS .....

MY TITLE .....

© 1947 U. S. Gutta Percha Paint Company

arms. This puts them more nearly in line with the pole, assuring better weight distribution. The third transformer is bolted to the back side of the pole. A bayonet pole pin supports the wire that completes the delta or the wye on the primary side so that the face of the pole is left entirely free for climbing. Fuses are placed on the primary arm at the top of the pole.

This method of mounting has two important advantages. First, the cost is less because one less arm is used and considerable hardware and labor are saved, and second, the center of gravity of the three transformers is much nearer the center of the pole than with other methods.

Many ordinances and codes call for mounting heavy transformers on double arms, and in this respect the new method complies because a set of double arms is used, but both on the same side of the pole instead of in the usual manner. Actually, even without the angle irons to tie all three arms together, it will be seen that greater strength is provided by the two arms together on the same side of the pole than in the ordinary set of double arms, one on each side of the pole.

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Use of Damper Windings on A-C Generators

III*—SYNCHRONIZING

WILLIAM L. RINGLAND
Electrical Engineer
Allis-Chalmers Mfg Co
Milwaukee, Wis.

SOME METHODS of synchronizing depend upon or are at least facilitated by damper windings. Synchronizing with a minimum of system disturbance requires that the incoming generator be operated at the same voltage and frequency and be in the same phase position as the system when the breaker is closed. However, this degree of precision is not obtained or is not required in many instances, the generator being connected to the system after it has attained a speed corresponding only approximately to the system frequency. The induction motor torque developed by the damper winding under such circumstances will considerably increase the permissible frequency difference. The induction motor torque developed by the usual low-speed generator damper winding at 5 percent slip is roughly 20 percent of full-load torque. This amount of torque may appear to be low in comparison with that normally developed by similar synchronous motors. But it must be remembered that the torque contributed by the field circuit at this slip without a suitable resistance in series is very slight, particularly for the larger generators, being a maximum at a much lower slip.

When a generator loses synchronism because of faulty conditions which are subsequently cleared, the torque developed by the damper winding will assist the generator to resynchronize automatically.

* This series began in ELECTRICAL WORLD, August 16, 1947, page 81.

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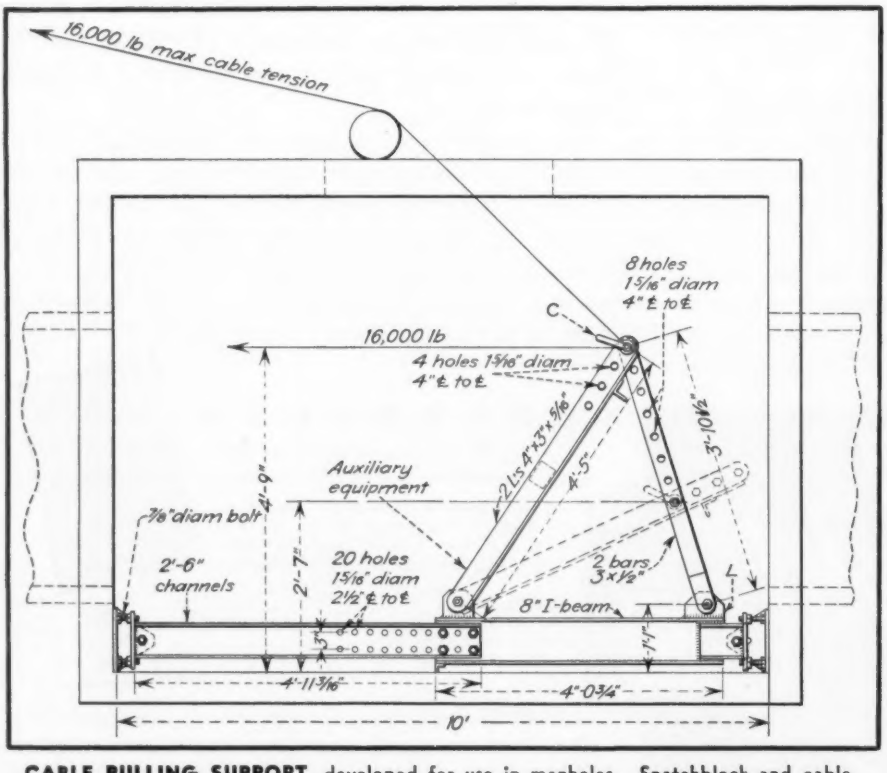


CABLE PULLING SUPPORT developed for use in manholes. Snatchblock and cable attachment are connected at lug (L) when adjustable brace with clevis (C) is not required

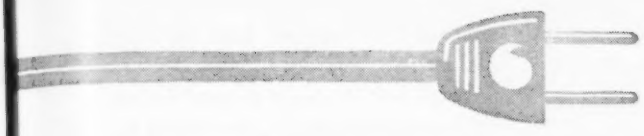
Cable Puller Support For Manhole Use

L. W. TOYE
Engineer
Public Service Electric and Gas Co
Newark, N. J.

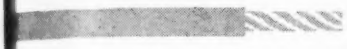
THIS BEAM SUPPORT, used for withdrawing cable from manholes, is made of structural steel and easily assembled on the job. The unit is designed for tension up to 16,000 lb and can safely take an overload of 25 percent beyond the maximum cable tension. The support eliminates the use of possibly corroded eyebolts in the manhole walls and the customary inadequacies of timber rigging.

As shown in the illustration, the assembly is placed longitudinally on the manhole floor since there is usually more freedom from existing cable facilities at that level than elsewhere.

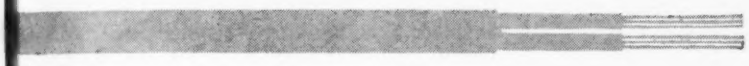
The principal member or assem-



If you get PWC products when you buy cord sets, flexible cords, building wire, power cables, telephone wire, control cables or any other of the many PWC products, you get *all* the important advantages of electrical insulation.



Leading engineers specify PWC for all applications. Immunity to most hazards and uniform high quality of workmanship means greater dependability, uninterrupted service, longer life, lower maintenance and replacement costs.



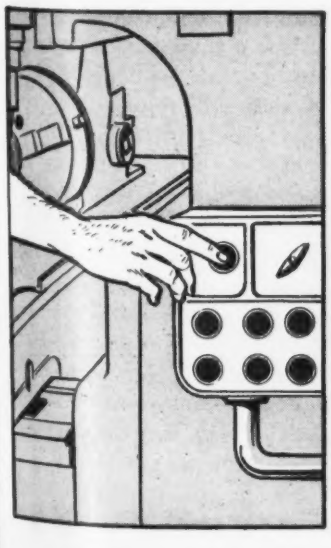
Plastic Wire & Cable Corporation is the world's leading exclusive manufacturer of plastic insulated wire and cable, a pioneer in development of plastic insulations for dozens of new applications.

Our technical bulletin, packed with facts and figures on the advantages of plastic insulated wire and cable, is yours for the asking. Or send us your requirements and let our engineers show you how well PWC products will meet your needs. Write Plastic Wire & Cable Corp., 407 Main St., Jewett City, Conn.

PWC

MEANS 10 WAYS BETTER

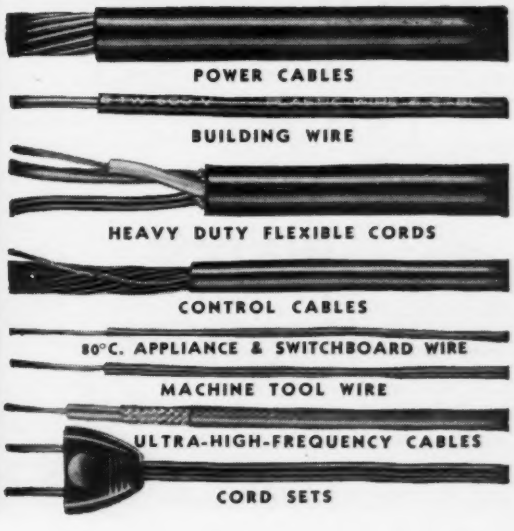
1. Superior dielectric strength.
2. Can't fray, crack or rot.
3. Low moisture absorption.
4. Greater mechanical strength.
5. Higher abrasion resistance.
6. Flexible over wide temperature range.
7. High chemical resistance.
8. Wide range of permanent, gem-like colors.
9. Non-combustible.
10. Lasting appearance.



PLASTIC WIRE & CABLE CORP.

Jewett City, Conn.

World's leading exclusive manufacturer of plastic insulated wire and cable



What more could you want when you're selling water heaters...

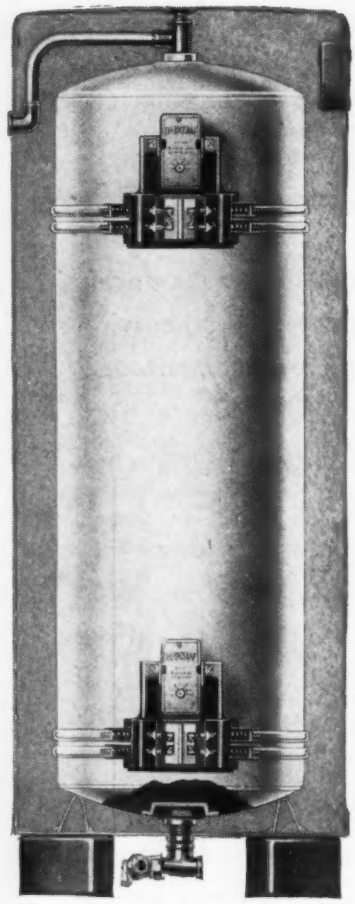
than this...

When you sell one of General Electric's new Electric Water Heaters, you're selling this—the very latest method of applying heat to water!

You're selling General Electric's heat-wrap Calrod* conduction units. And how these units heat water!

Held tightly against the tank by spring tension, they apply heat by conduction under constant pressure. Result: maximum heating efficiency for low-cost operation.

What's more, you don't have to drain the tank when making wattage substitutions or unit changes. No plumbing fittings involved.



and this...

Every new General Electric Water Heater has a place for this special magnesium-alloy protector.

It's an accessory easily installed right in the field. Takes just a few minutes. Protects ordinary galvanized tanks from corrosive water. Lengthens tank life.

and these!

Complete warranty. If tank leaks develop within one year, we will replace entire heater. (Five years on Monel tanks.)

Blankets of the new Fiberglas insulate the tank—keep heat in the water. Tank has only two openings. Each heater increases your average domestic load by 3600 kilowatt-hours.

Maximum of six standard General Electric Units meet any wattage requirements. Servicing and unit stocks greatly simplified. General Electric Company, Appliance and Merchandise Department, Bridgeport 2, Conn.

*Trade-mark Reg. U. S. Pat. Off.

15- to 82-gallon capacities—galvanized and Monel Tanks

AUTOMATIC ELECTRIC

WATER HEATERS

GENERAL ELECTRIC

bled beam is lowered into the manhole in two sections. These sections one with back-to-back mounted channels between which is placed one end of the I-beam section, are then connected by four bolts. The assembly is aligned with the cable to be withdrawn. A wall abutting plate, having an area of 90 sq in at each end of the beam, is adjusted and tightened by three bolts. The beam resists uplift by a combination of wedging and frictional resistance against the walls.

Adjustable Brace Provided

With the beam in position, a snatchblock is attached to the lug in the wall end of the I-beam section. If cables are to be withdrawn from higher positions in the manhole, an auxiliary equipment or adjustable brace is provided. This assembly of two flat bars and two single pieces can be set at 32 elevations between the vertical distances of 2 ft 7 in. and 4 ft 9 in. from the manhole floor.

The apparatus, used in manholes up to 10 ft in length, weighs approximately 300 lb. For 14- and 16-ft manholes, a steel section can be attached between the I-beam and channels. The adjustable brace weighs about 125 lb.

•

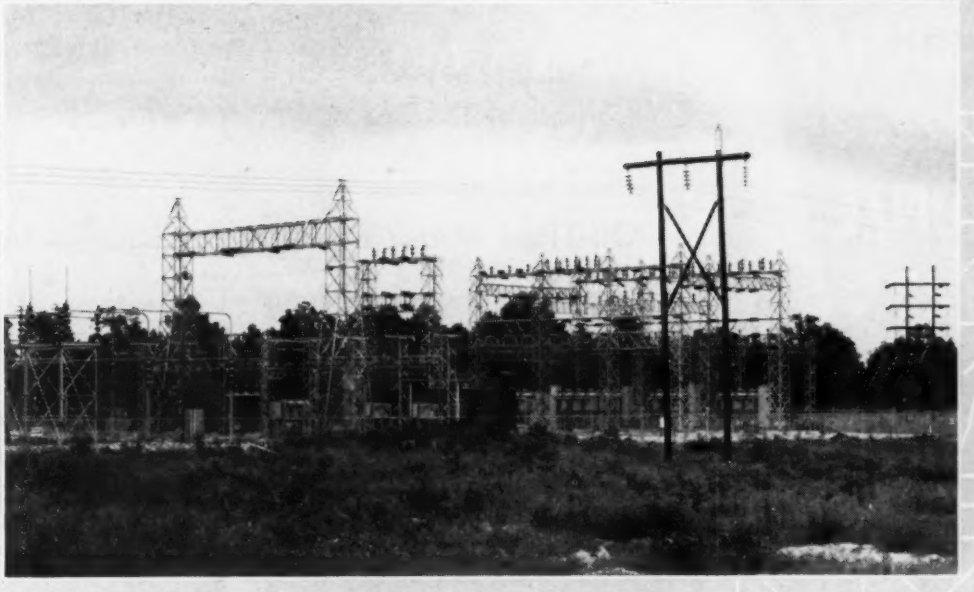
Insuring Full Coverage By Danger Signs

To avoid haphazard installation of danger signs on transmission and distribution systems, an eastern utility established certain regulations concerning the location of such signs:

Regulations

(1) Signs are required on each leg of every steel tower supporting conductors forming circuits with potentials above 750 volts. All major points of the compass are thus included, leaving no excuse for partially equipped towers relying on signs facing normal approaches only and omitting warnings on sides which may normally appear inaccessible, but which may in reality form Maginot Lines of defence against trespassers.

(2) At substations danger signs are required in conspicuous locations on the outside of each fence gate, with at least one sign per 100 ft of length on each side and rear fence of the substation enclosure. On long



BLUEPRINT *for* SOUND DESIGN

Any well-constructed substation is dependent on a **sound design** engineered to meet specific requirements. This basic design is represented by the "blue print" of engineering "know how," plus proper materials, plus a knowledge of the functional use of proper equipment, **plus the integrity and experience of a dependable manufacturer.**

In your "blue print," include the knowledge of Southern States' engineers—men with years of experience in station construction, in the manufacture of high voltage equipment—men with practical **field** experience in the power industry. These men **know** your problems—your needs—not only through manufacturing experience with Southern States, but by virtue of having lived these problems with operating companies.

Behind the knowledge and experience of these engineers stands the special facilities of Southern States Equipment Corporation—facilities complete enough to assume the largest job, yet sufficiently flexible to be devoted to the smallest design. From a one-line diagram and a plot of the available real estate or from complete specifications, Southern States stands ready to develop designs of any size and voltage **to meet your specific requirements.**

Here's your blue print for a soundly designed substation—complete in every detail and designed to do **your** job efficiently and correctly. We invite your inquiry. Address it to Box 474.

400 Amps. to 1200 Amps.
Write for Information and Bulletin No. 326

Southern States Equipment Corp.

HOME OFFICE AND FACTORY — HAMPTON, GEORGIA

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MILWAUKEE, WISCONSIN

FOR
STRENGTH
AND
DURABILITY!
Silicon
BRONZE
BOLTS

Extra strength ... resistance to corrosion ... resistance to season cracking ... these are some of the qualities of Harper Silicon bronze fastenings which have led to their use by scores of power companies and electrical equipment manufacturers. These fastenings go into sub station assemblies, pot heads, pole line hardware, grounding equipment, and a host of other applications.

5200 ITEMS IN STOCK

Harper maintains a large and widely assorted stock of Silicon bronze bolts, nuts, screws, washers, and rivets. Moreover, similar stocks are maintained in brass, naval bronze, copper, Monel and stainless steel. Ask for summarized catalog.

ASK HARPER ENGINEERS

Harper engineers specialize in the manufacture and use of non-ferrous and stainless fastenings. Submit your fastening problems to them.

The H. M. HARPER COMPANY
2611 FLETCHER STREET
CHICAGO 18, ILLINOIS
Branches or representatives in principal cities

HARPER
Chicago

EVERLASTING FASTENINGS

lengths of fence or on short lengths requiring more than one sign, signs are evenly spaced unless approaching streets, walks or adjacent obstructions necessitate irregular spacing. All substation entrance doors call for signs, including customer-owned substations.

(3) Each door or gate of a transformer vault (excluding sidewalk vaults) is required to be provided with a danger sign. A sign must be placed inside a sidewalk vault in such a location that it will be readily seen on opening the vault door.

(4) Signs must be placed on pole regulator or transformer platforms, one on each side near the pole, readily visible from ground; similarly on platforms, attached to buildings.

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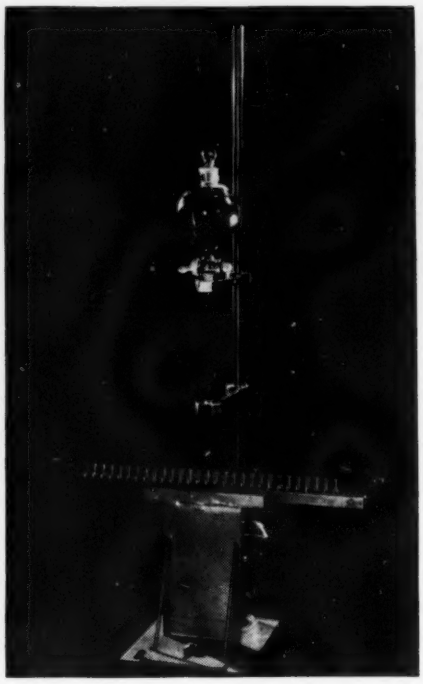
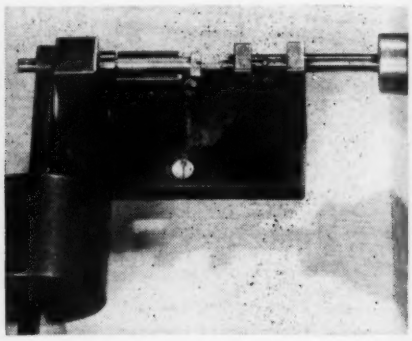
Oil-Tight Meter Bearings Assembled by Fixtures



FIXTURE allows one drop of oil to flow to each screw of oil-tight jewel bearings



GUIDE BUSHINGS are tightened by a crank-operated screw driver against an adjustable weight set for correct torque

J. C. HUMBEL
Meter Department
The Detroit Edison Co
Detroit, Mich.

OILING and assembling of oil-tight jewel bearings has been facilitated by the use of two devices which are shown in the accompanying illustrations. Built in the meter department shop testing and repair division of The Detroit Edison Co, they are similar to specifications furnished by the manufacturer of the bearings.

The oiling device consists of a separating funnel holding jewel oil, mounted above a support on which a rack holding the screws can be moved. The flow of oil, controlled by a stop cock, is set to drip at the rate of 30 to 40 drops per minute. This allows the operator to move a rack of screws under the funnel, stopping it long enough to allow each screw to receive one drop of oil.

The device for tightening the guide bushings consists of a crank-operated screw driver which engages the head of the jewel screw, a support for the screw, and a wrench which engages the guide bushing. The wrench is connected to a lever holding an adjustable weight which raises when the bushing is tightened to a torque of 40 in.-oz.

"That you, Kaufmeyer?"

SIMPLEX VARNISHED CAMBRIC CABLES *for high Temperatures*

IF you must run your conductor temperatures high, you can save money and get dependable service by installing Simplex Varnished Cambric Insulated Cable.

Simplex Varnished Cambric Insulation will stand up longer than other types under such conditions. It will stand large temporary overloads and sudden voltage surges without becoming damaged.

Simplex Varnished Cambric Cables are furnished with either lead sheaths, treated braids or rubber jackets to meet particular service conditions. Special coverings can be provided for cables in unusual installations.

When you next need a heavy power cable for high temperature service, a Simplex engineer will be glad to tell you whether a Varnished Cambric Cable will fit your conditions.

Simplex **WIRES & CABLES**

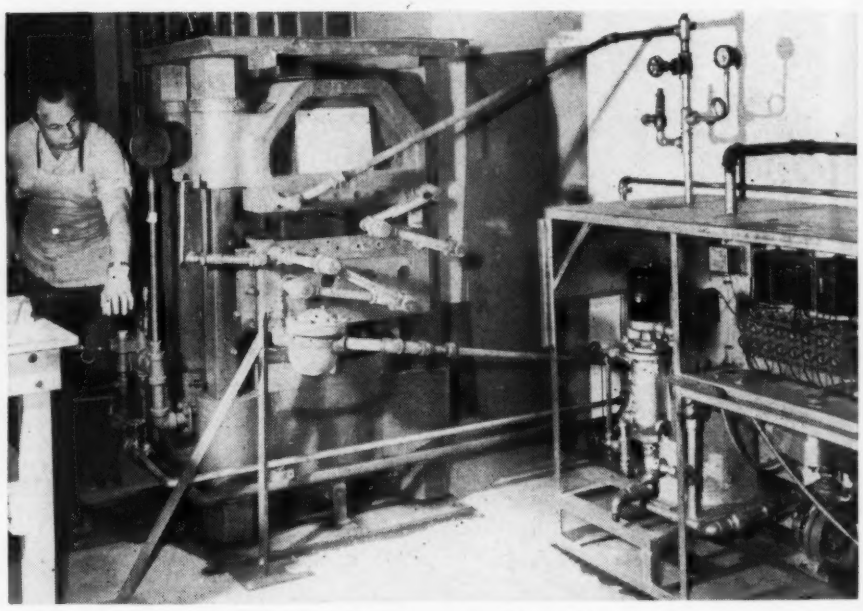
SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

LOAD BUILDING

Electric-Steam Heating Cuts Spoilage

SPOILAGE in curing some of the rubber plates or mats used in printing has been completely eliminated in the plant of the Western Paper Converting Co, of Salem, Ore., by use of the 45-kw electric-steam generator illustrated.

Trouble with the old system, which consisted of a gas-fired boiler with long steam line, was inability to hold the plates of the press at the constant temperature of 312 F required for proper curing or vulcanizing. Some plates would be spoiled and valuable press-time lost. With the electric boiler it was possible to place the unit adjacent to the press as shown, and with its accurate temperature and pressure control, there has been no spoilage whatsoever. Moreover, heat-up time in the morning is greatly reduced, effecting a substantial saving in labor. The "flash" type boiler made by the Cronholm Manufacturing Co of Portland, Ore., will produce a steam pressure of 100 lb from a cold start in one minute with closed steam line. To heat the great mass of metal in the press to a uniform temperature takes about an hour. Average power demand is 15 kw, for the Adamson plate press, which leaves ample capacity to heat an embossing machine at a later date. Power rate will run 8-9 mills per kwhr.



RUBBER PRINTING PLATE PRESS is steam heated by 45-kw electric steam generator; eliminates lost press time and plate spoilage occasioned by varying steam supply

• • •

Capacitor Rental Encourages Power Factor Correction

H. W. MEEKS
Manager, Electric Department
Jackson, Tenn.

PAYING a little bigger bill each month is preferable to spending some hundreds of dollars for correction of low power factor. Most industrial consumers feel this way. Recognizing this, and also that improved power factor benefits the utility as well as the customer, the Electric Department of the City of Jackson, Tenn., offers capacitors for rent to its local industrial customers.

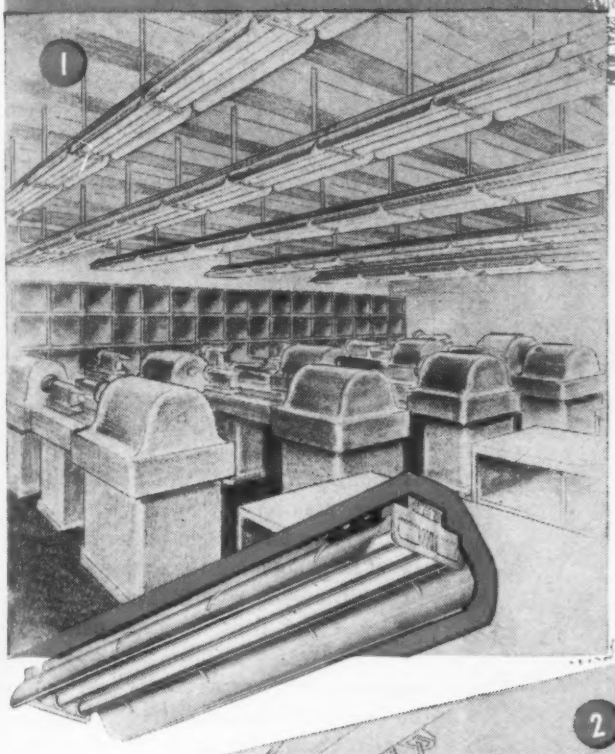
Demand charge is billed on the highest average measured 30-min kilowatt load in the month if power factor is 85 percent or more. If power factor is less, demand charge may be billed at 85 percent of the highest average kva measured over a 30-min period. This is at the option of the department. For the purpose of billing, this quantity is taken as kilowatt demand and the stated rate is applied to it. For loads below 100 kw, the monthly demand charge is 85 cents per kilowatt. There is no charge for the first 10 kw. Thus, a load of 80 kw at 85 percent power factor or above has a demand charge of \$59.50 (80-10 $\times$ 0.85). If the power factor were 75 percent, the demand quantity would be 80.7 kw (80/0.75 $\times$ 0.85 — 10) and the charge \$68.60. The charge for low power factor would be \$9.10.

To correct the load to a power factor of 85 percent requires the installation of 21.6 rkva. Two 15-kva capacitors, costing about \$400, would be needed. This, with installation, is an outlay many customers would prefer to avoid; even at the expense of paying 9 or 10 dollars more on the monthly bill.

The capacitors for rent by the Jackson utility meet this problem. The renter pays the cost of installation. For capacitors that bring power factor up to 85 percent, the rental is 5 cents per kva per month. Thus, in the example cited, the customer could reduce his bill by the difference between \$9.10 and \$1.50, or \$7.60 per month. The customer will also profit

Guth LIGHTING IS GOOD LIGHTING

...for Every Industrial Lighting Need!



1 *The FACTORY* needs clear, fast-seeing, rugged lighting equipment that speeds production, reduces accidents, and minimizes maintenance. GUTH Mazelites,* with tough 300° WHITE Reflectors, have an 85% lighting efficiency. The ribbed construction and bump-proof ends add the vitally needed durability.

2 *The OFFICES* want modern, attractive, evenly-distributed illumination that reduces errors... keeps workers comfortable and happy. Beautiful GUTH Aristolites* deliver uniform, diffused light to the working surface, without fatiguing glare or distracting contrasts.

3 *The SALESROOMS* require high levels of brilliant light to enhance the attractiveness of the finished products, and present a cheery, inviting appearance. GUTH Trucolites* direct intense lighting downward to give the merchandise sparkle and eye-appeal.

For full details about GUTH Lighting
Write today

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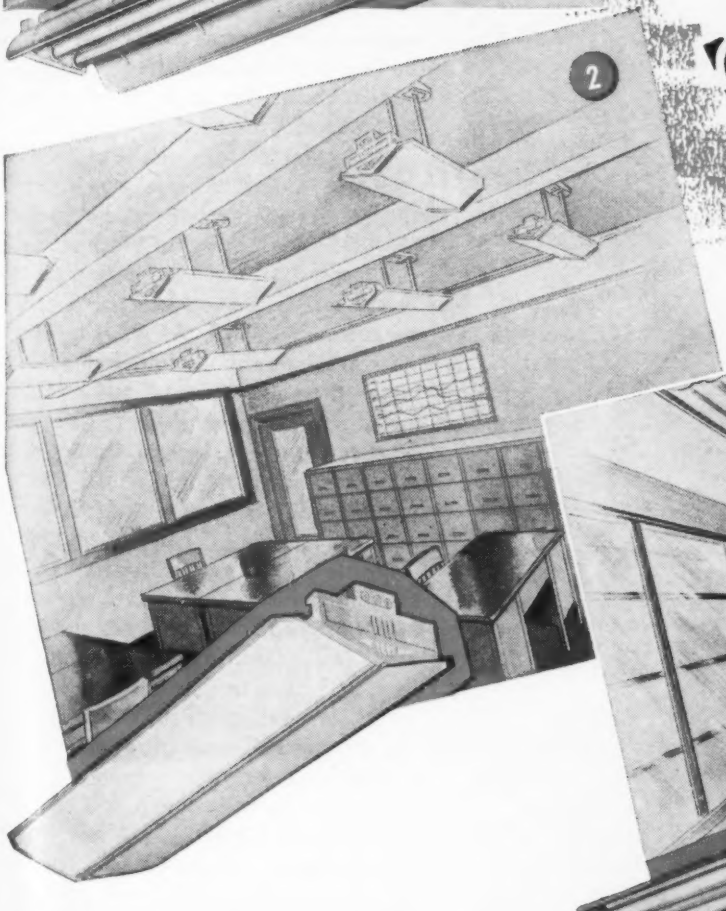
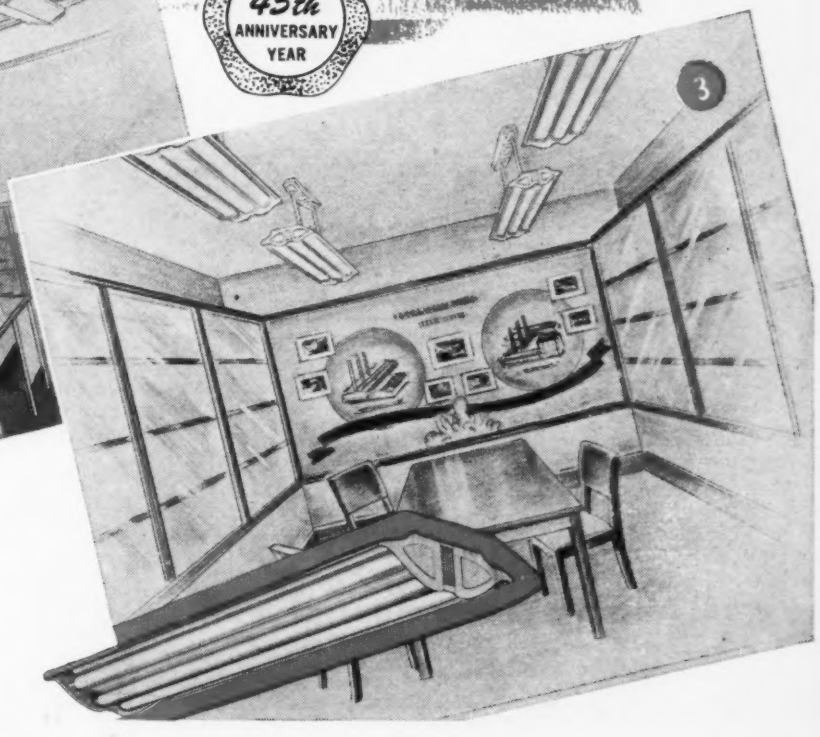
THE EDWIN F. GUTH COMPANY

Guth *Leaders in Lighting Since 1902*

ST. LOUIS 3, MO.



OUR 45th ANNIVERSARY YEAR



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Lighting Equipment
A complete line of quality lighting units from a single source.
COMMERCIAL
INDUSTRIAL
FLUORESCENT
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SILV-A-KING lighting equipment has been incorporated in major installations, throughout the country, for over a quarter-century . . . a tribute to craftsmanship . . . to modern manufacturing methods . . . to a continuing program of research into every phase of illumination.
SILV-A-KING Lighting Equipment is sold exclusively through recognized electrical wholesalers.
SILV-A-KING LIGHTING EQUIPMENT
BRIGHT LIGHT REFLECTOR CO. INC.
subsidiary of
BRIDGEPORT PRESSED STEEL CORP.
Bridgeport 5, Conn.
RLM

by improved voltage conditions and increased energy capacity of his wiring and other facilities.

This rental of 5 cents per kva applies to capacitors rated at 460, 2,400 and 7,200 v. For 230 v, the charge is 10 cents. If existing power factor is 85 percent or above and the customer desires to have it higher, the rental charge is reduced by 4 cents in each instance. These differences in rental charges recognize that the utility usually benefits more than the customer by upper-range correction of power factor.

•

Electric Heat for Cheese Processing

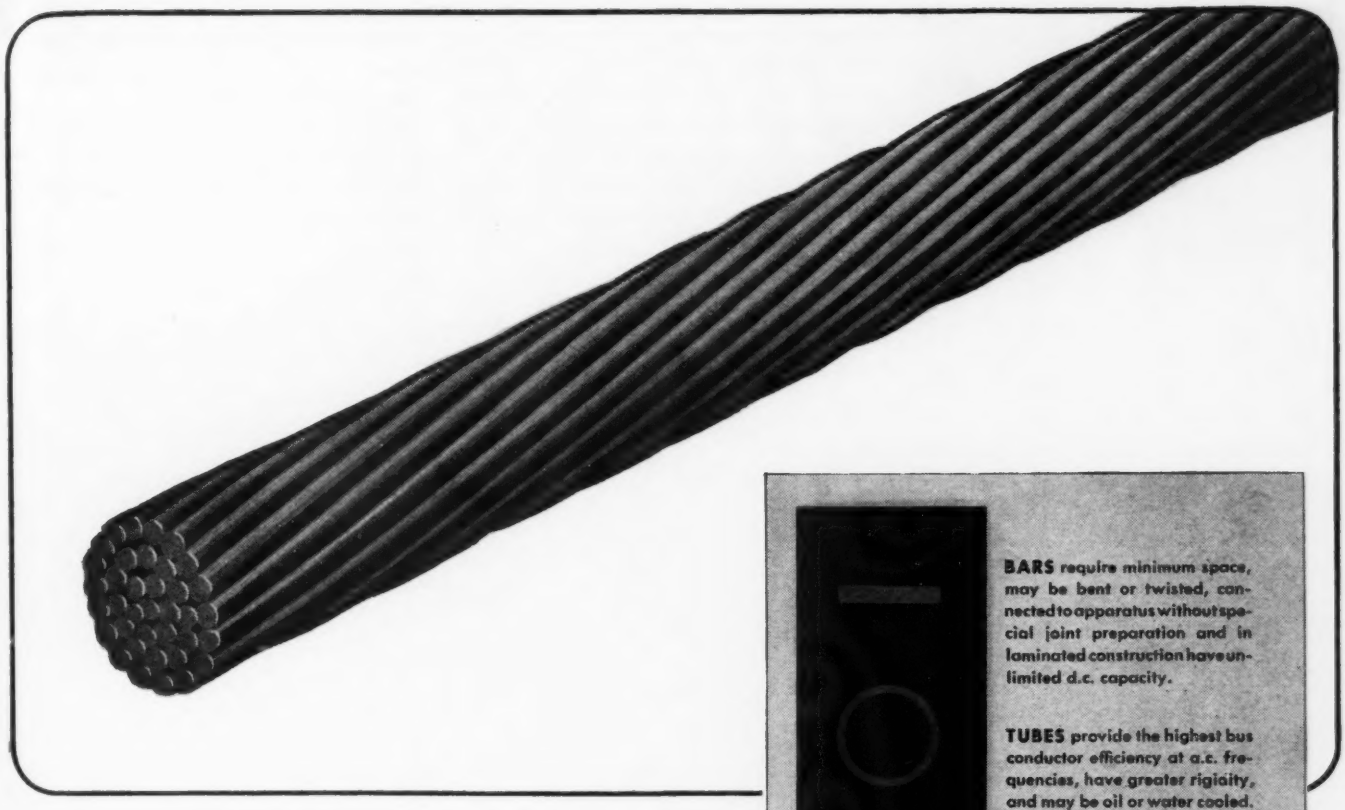
McGraw-Hill World News

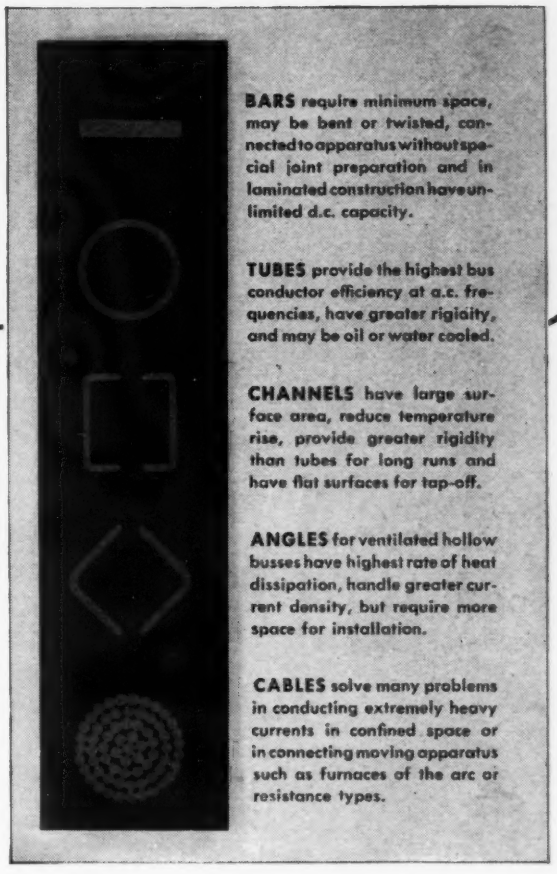
AGAINST the cost of alternative available fuel (wood), electricity in the cost range of 6-7 mills per kwhr is found economical as heat source in cheese making in Switzerland. Hot water from an electric boiler is circulated to processing tanks and to radiators in curing rooms. The system is a closed one, thus avoiding calcification and other deposition, and permitting water temperatures well above boiling point. It is called the "Magro" system, from the name of its inventor, Marcel Grossen.

Particular feature of the system is use of a pump to raise water from the bottom of the boiler tank to the top where the heating units are placed. A thermostat starts the pump when the water at the top reaches a temperature of 295 F. As the top temperature drops by the inflow of cooler water, the pump shuts off and restarts as the new water is heated. This cycle continues until a second thermostat cuts out the pump motor at a maintained water temperature of 299 F.

The heating unit consists of three elements of 7.8 kw each, one of 2.6 kw and a reserve of 4 kw. The elements are controlled by a motor-operated switch that connects them in fixed order and timing. Energy is normally used during off-peak hours, but the time switch may be bypassed if production operations require.

The system, as installed in a cheese factory near Langenthal which normally produces one 200-lb wheel a day, has a boiler of 580-gal capacity and a reserve tank that holds 320 gal. Thus, if required, 900 gal of 299 F





BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.

Copper Cables

. . . for heavy currents and flexibility in confined space

A BUS of cable connections is sometimes more convenient than the more rigid conductor shapes. One example is where extremely heavy currents are required in a confined area.

Flexibility is another advantage offered by cable conductors. They are used for this reason in connecting the main bus run to the electrodes of arc furnaces and resistance furnaces of high capacity.

Anaconda Bus Conductors are made in this and the four other standard shapes illustrated. Each is produced in a wide range of capacities, and all are made of *copper* . . . the bus conductor material that combines low electrical resistance, high thermal conductivity and high corrosion resistance with adequate strength. For detailed information, write for Anaconda Publication C-25. 47100

ANACONDA
from mine to consumer

Anaconda

BUS CONDUCTORS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

water are available. The reserve tank is equipped with a small wood furnace used in the winter for heating the plant when cheese making slows down and electricity is scarce.

Operating records for the spring of 1946 show an average electricity cost of 6.1 mills per kwhr as follows:

	April	May	June
Milk used, monthly, in metric tons	23.8	38.2	38.2
Kwhr used by Magro installation	2,029	3,511	4,011
Kwhr used per metric ton milk.	85.28	91.88	105.03
Total cost of energy, dollars...	12.30	21.40	24.40
Energy cost per metric ton milk, dollars	0.52	0.56	0.64

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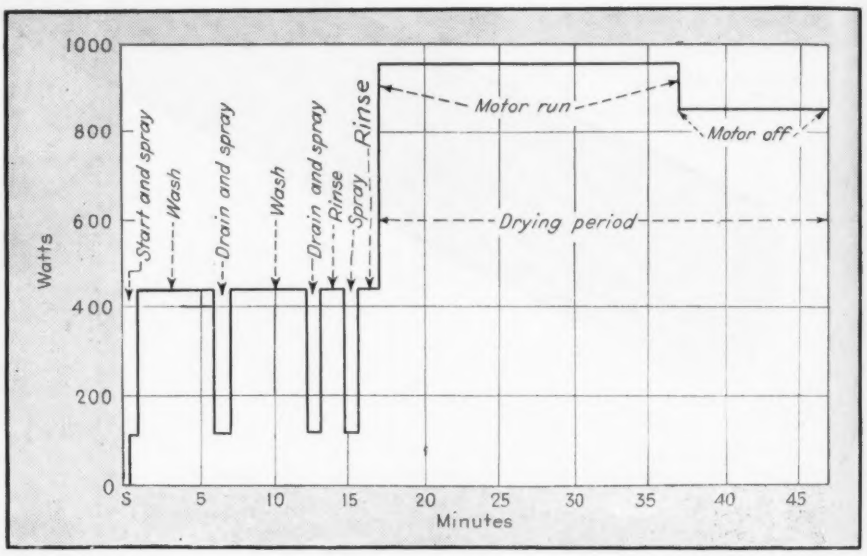


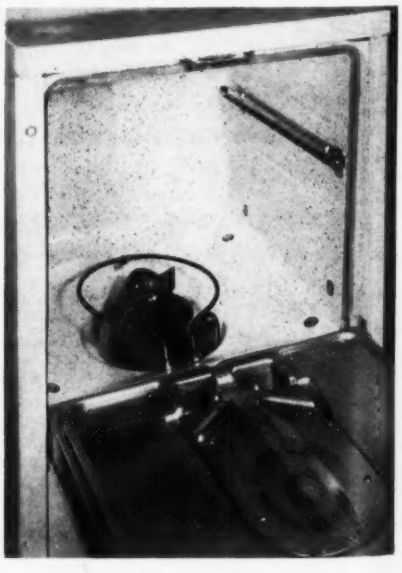
OPERATION from pushbutton start through 47 minutes of washing, rinsing and drying is controlled by timer relay. The ¼-hp motor operates continuously until the final 10 minutes of drying

Dishwashers Are Major Load Builders

LOAD-BUILDING possibilities of the electric dishwasher are considerably greater than have been commonly realized, according to technical data prepared by the engineering department of Hotpoint, Inc. Average use estimates, including extra hot water requirements, are 1,285 kwhr annually. About one-third of this consumption is by the dishwasher and automatic drying unit.

The accompanying chart shows graphically the cycle of operation set up in the automatic timing control of the new Hotpoint dishwasher. Two cycles of washing and spraying and two rinse periods are followed by a 30-min drying period, with heating supplied by an 850-watt Calrod unit. Maximum demand of the dishwasher, during 20 min of the drying operation, is 960 watts including the motor drive for the fan.

Consumption for each dishwashing, as represented by the area under the curve, is approximately 0.6 kwhr. Expected normal use is for two washes per day, giving an annual consumption of 425 kwhr. Since dishwashing will usually be done after cooking is completed, it is anticipated that addition of dishwashers will not increase maximum demands on the distribution system and that load factors of all-electric kitchens will be improved.



CALROD heating unit and combination water impeller and fan are in base of washer tub. Vertical-shaft motor and control panel are in compartment below

Made to SELL . . . with CHROMEL*

. . . the Original Nickel-Chromium Heating Element Wire

Chromel
NICKEL | CHROMIUM WIRE

* Trademark Registered U.S. Pat. Off.

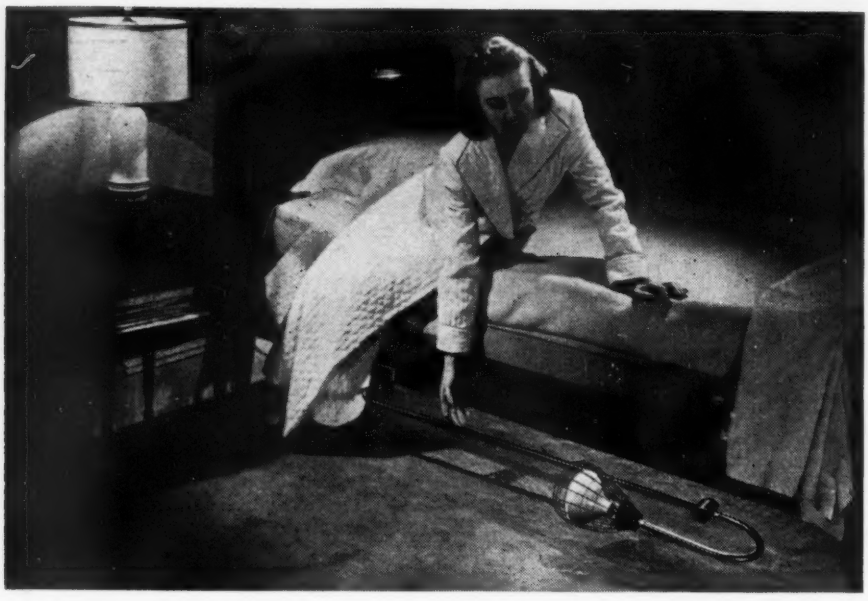
B. C. (that's "Before CHROMEL") a slice of crisp, evenly browned, good-to-eat toast was a chance occurrence over an open flame. Now, it's a "pop-up" cinch! Good and golden brown toast has become America's breakfast habit thanks in large part to the durable, dependable CHROMEL Heating Elements used in modern automatic toasters.

CHROMEL, you know, is the Nickel-Chromium resistor wire that first made electrical heating practical. It provides a clean, even, odorless heat quickly, conveniently and economically . . . and it represents an important factor in building and maintaining your domestic and industrial heating loads.

Our Catalog-M1 is devoted exclusively to helpful technical information on the CHROMEL Alloys and their application . . . facts of interest to your Load Building Department. Want a reference copy?

HOSKINS MANUFACTURING COMPANY • Detroit 8, Michigan

NEW EQUIPMENT



Fold-Away Sunlamp

A NEW SUNLAMP designed to fold under the bed and featuring a built-in automatic timer has been announced by the Appliance Division of General Electric Co, Bridgeport 2, Conn. The unit employs an RS sunlamp bulb to deliver the ultra-violet energy. A wire guard protects the bulb against damaging jars or shocks.

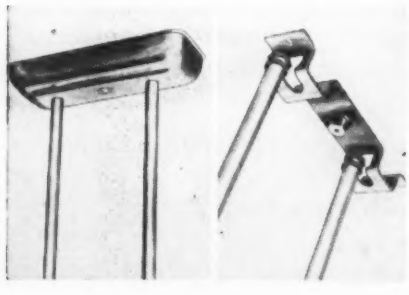
Constructed of Bonderized aluminum and finished in baked walnut enamel, the lamp has a gooseneck at the top to permit the rays to be adjusted to any angle. Finger-tip manipulation to swing the lamp up and over the bed is secured by means of a swivel joint and counter-balancing mechanism. The built-in timer turns the lamp off when the desired length of exposure has been reached.

•

Fixture Pendant Set

DESIGNED to blend more effectively with the company's line of commercial fluorescent fixtures, and to save installation time, a new type pendant set is now being supplied by Sylvania Electric Products Inc, Salem, Mass.

The canopy (left) is streamlined and is secured to the assembly with one centrally located screw. Mounting strap (right) can be secured to the ceiling by a hickey-nipple combination, fixture extension, toggle bolts or wood screws. It has cut-away slots which engage the stems and locknuts after the fixture is assembled on a bench or floor.



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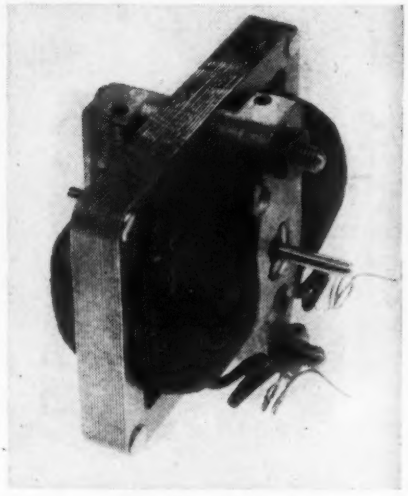
Low-Melt-Point Solder

A SILVER SOLDER reported to have a shear strength of 105,000 lb per sq in. and a melting temperature of 1,076 F is a product of the All-State Welding Alloys Co, Inc, 96 West Post Road, White Plains, N. Y. Silver content of the alloy is 40 percent, with the remainder made up of cadmium, copper, and zinc. This All-State No. 111 silver-brazing alloy is available in wire, strip, or rings, and is used with All-State No. 100 flux. It is stated to be suitable for the fabrication and repair of electrical and refrigeration equipment.

Shaded-Pole Motor

A 4-POLE, single-phase, shaded-pole, fractional horsepower induction motor has been developed by Gleason-Avery, Inc, Auburn, N. Y. The standard motor is wound for a nominal 24-v, 60-cycle or other voltage or 25-cycle use.

Because the input power is substantially constant from no-load to blocked-rotor conditions, when operating under constant voltage, this B-30-A motor may be used in operations where the load is driven against a stop. It can then remain energized in this stalled position without being overheated, according to the manufacturer. Where the duty cycle demands that the motor be continuously energized, the winding is designed so that the total temperature does not exceed approximately 90 C. Speed-torque and heating curves are available.



The motor may be assembled for either clockwise or counter-clockwise rotation. A reversing motor can be obtained by mounting two motors back to back and using a common shaft.

•

Electric Blanket

AN ADDITION to the Everhot line is an automatic electric blanket announced by The Swartzbaugh Manufacturing Co, Toledo 6, Ohio. Designated Cat. 920, the blanket is 72x90 in., 75 percent wool, 25 percent cotton, with wide rayon satin binding with boxed ends. Colors are rose and blue. Wiring is spiral single wire with waterproof insulation. Safety

UNSUNG HEROES OF POLE LINE CONSTRUCTION

Simple things, CROSS ARM BRACES, just a strip of flat steel with a hole punched in each end, but most important to a pole line. Hubbard Braces are fabricated from the best, new, open-hearth steel and all corners are rounded to protect linemen from sharp projections. For the engineer who wishes additional strength on the compression side of the arm, the ribbed brace is provided and offers approximately 25% added protection.

HUBBARD FLAT AND RIBBED CROSS ARM BRACES

HUBBARD ANGLE CROSS ARM BRACES, for heavy construction, are supplied in a range of spreads and drops to meet the requirements of any standard construction. Angle size runs from 1½ to 2-inches. At the pole attachment hole, the angle is so formed that wrench clearance is provided. Attachment is by ⅝-inch Machine Bolt at the pole and ½-inch Carriage Bolts at the arm.

HUBBARD ANGLE CROSS ARM BRACE

DRIVE POINT MACHINE OR CROSS ARM BOLTS are roll-threaded to provide a "finger-fit" for the full length of the thread. The "Drive Point" feature enables the bolt to be used as a drift pin for the alignment of holes slightly off center. This operation must be carried out with caution so as not to injure the threads. "Drive Point" also facilitates the application of nuts and allows bolts to be driven out of the pole for reclamation without injury to the threaded end. The major portion of Hubbard bolts of all types have this feature.

HUBBARD DRIVE-POINT CROSS ARM OR MACHINE BOLT

HUBEYE BOLTS are furnished for attachments of any kind where a thimble would normally be used. The eye of the bolt is drop-forged to a shape which provides a perfect "built in" thimble. Strand may be looped around the Hubeye with complete protection. Side walls of the eye retain the roundness of the strand. There is no possibility of kinks or strains at the loop. Hubeyes are a thoroughly tried and proven product.

HUBEYE DRIVE-POINT BOLT

STANDARD HUBBARD OVAL-EYE BOLTS are an old line item still much used in many sections. Hubbard Eye Bolts are all drop-forged with an eye that is stronger than the shaft of the bolt. Made from the best, new, open-hearth steel and Hubbard Double-Dip Hot Galvanized.

HUBBARD OVAL-EYE DRIVE-POINT BOLT

HUBBARD AND COMPANY

PITTSBURGH CHICAGO OAKLAND CALIF.

Look to Locke for Distribution Materials...

Guy Clamps

for instance...

This is the Locke No. 6461 heavy-duty guy clamp—for strand sizes 5/16-inch to 1/2-inch. It is one of a complete line of Locke guy clamps. Holes line up accurately for easy installation. The ends of the grooves are rounded to prevent damage to the strand. Carbon steel bolts develop full holding power—the threads will not strip. And, of course, it has *Permazinc*—Locke's ***Quality Controlled*** double hot-dip galvanizing —for extra years of dependable performance.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks.

Depend on Locke for *Quality Controlled* distribution materials—pole line hardware and insulators. ***One*** order covers ***both.***

Locke

POLE LINE HARDWARE *and* INSULATORS

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MARYLAND

thermostats guard against overheating.

Control assembly is in white plastic box having a temperature selecting dial, on-and-off switch, and glow light. A 12-ft cord connects to the blanket and a 6-ft cord to the outlet to supply 1.6 amp at 115 v a-c only.

•

Engine-Driven Welder

A NEW Flexarc lightweight engine-driven welder, designed for 200 amp at 30 v on the basis of 50 percent duty

cycle, is available from Westinghouse Electric Corp, Pittsburgh 30, Pa. Each welder has accessories which include work and electrode leads, helmet, electrode holder, a supply of electrodes and a wire scratch brush.

Known as "The Ranger," this d-c welder is available either as a portable or stationary model. The generator is direct-connected to a Hercules IXB engine. The welding current is adjusted over a wide range from 30 amp at 20 volts to 250 amp at 30 volts in four major steps by plugging screw locking plugs on work and electrode leads. Intermediate values of current are obtained by rheostat control. Polarity is controlled by interchanging work or electrode lead connections.

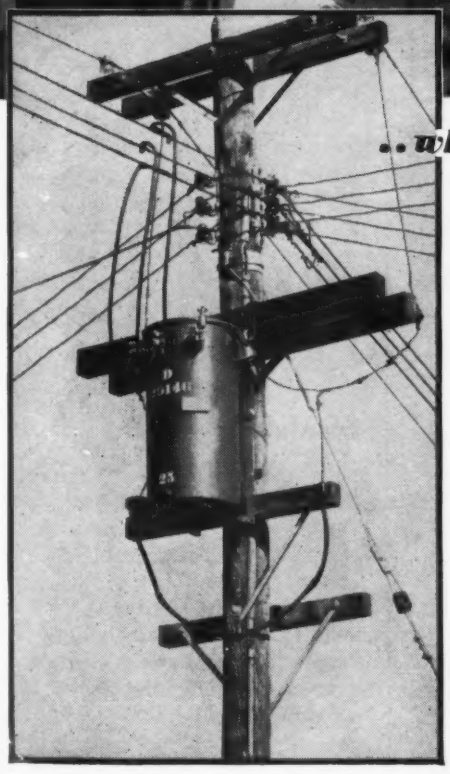
•

Miniature Capacitors

CAPACITORS molded in flat, mica-filled phenolic cases for use in electronic devices, hearing aids, pocket radio receivers and other applications in which economy of space is a primary factor are now available from Tobe Deutschmann Corp, Canton, Mass.

Dimensions are as follows: 0.001 and 0.005 mf, $\frac{9}{16} \times \frac{5}{16} \times \frac{3}{32}$ in.; 0.05 mf. $\frac{11}{16} \times \frac{23}{64} \times \frac{7}{32}$ in. Working voltage of all units is 75 d-c. Terminal leads are solid, tinned copper and are said to support the unit without need for other mounting provision.

The units are reported to be case-sealed against 80 percent relative humidity. Operating temperatures are from minus 55 C to plus 65 C; the 0.001- and 0.005-mf ratings can also be



...whether Your Power Problem is Large or Small

a Wagner Transformer Can Solve It!

MIDGETS on poles—Giants in Power Plants—Wagner Transformers are giving account of themselves by maintaining continuity of service. They keep the lights burning in homes . . . They keep the wheels of industry turning with unfailing dependability that has made Wagner Transformers world famous.

Whether your power problem is large or small—Wagner can furnish the transformer that will give you the solution. Users of Wagner transformers also profit by our quick, convenient, nation-wide service facilities.

Fifty years of experience and knowledge, gained in furnishing transformers of all sizes and types, stands behind every Wagner product. Twenty-nine branch offices manned by trained field engineers are ready to serve you.

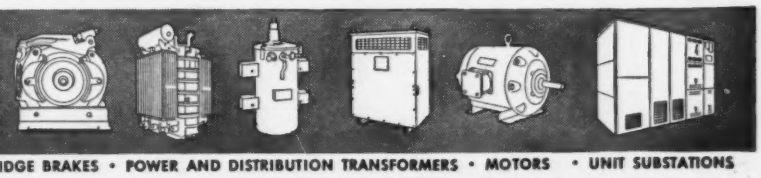
Write for Bulletins TU-180 and TU-181

Address Wagner Electric Corporation, 6456 Plymouth Avenue, St. Louis 14, Mo. for these valuable Bulletins on the complete line of Wagner Transformers.

T47-4

Consult Wagner Engineers on All Transformer Problems

Wagner Electric Corporation EST. 1891



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL AND AUTOMOTIVE PRODUCTS

STANDARD ELECTRIC TACHOMETERS

STANDARD electric Tachometer SG-6. Compact, rugged unit; cast aluminum case. Generator either screw or flanged; 30 foot connecting cord.

keep an accurate eye on speed!

STANDARD electric Tachometers indicate RPM . . . calibrate other rotating indicators . . . measure Diesel or gasoline engine speeds. A single glance gives you readings to ± 10 between 200 and 3500 RPM's. Accuracies for higher speeds in proportion. Synchronous-type drive does away with inaccuracies common to voltmeter types of tachometers; they practically never need recalibration.

STANDARD electric Tachometers have a 6" diameter scale. Large hand covers the full scale range with 3½ revolutions, giving a scale length of 66". Depend on this wider range to give you the facts . . . to respond instantly, operate smoothly for years — and years.

Write about these other STANDARD products:

Precision Timers	Bulletin 153
Laboratory Time Standards	95
Watthour Meter Test Benches and Custom Built Laboratory Panels	151
Electric Clock and Program Systems	131

Please mention this publication when writing.

T-1

THE Standard Electric Time Co.

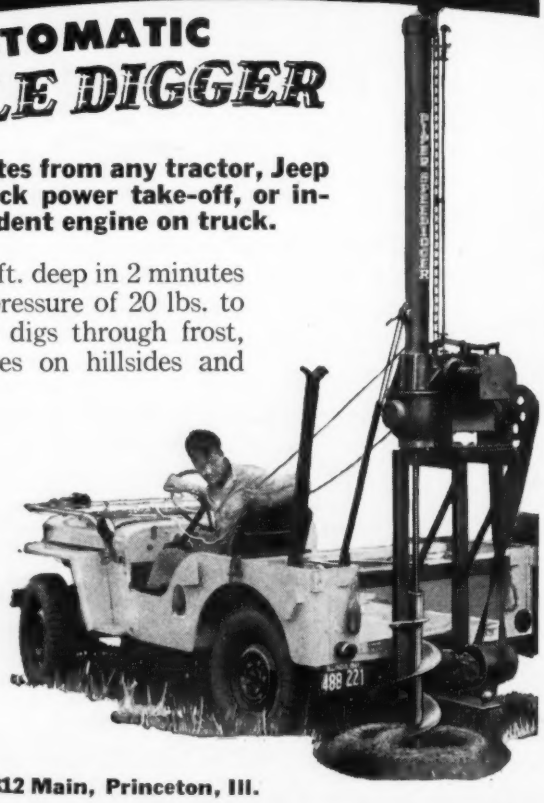
SPRINGFIELD 2 STANDARD FOUNDED 1884 MASSACHUSETTS

Now! A Low-Cost Digger that is Built to Do the Job!

PIPER AUTOMATIC POLE-HOLE DIGGER

Operates from any tractor, Jeep or truck power take-off, or independent engine on truck.

Digs a clean hole fully 6½ ft. deep in 2 minutes or less! Adjustable down pressure of 20 lbs. to 2,000 lbs. Heavy duty — digs through frost, gravel, roots, etc. Operates on hillsides and slopes. Augers of 12 in. or 14 in. diameter. Operated by trip-ropes. Fully automatic—foolproof. Backed by more years of experience than any other digger on the market. Built by the leading manufacturer of hole-digging equipment. *Priced less than $300!* Prompt delivery. Write.



R. J. PIPER MFG. CO., 812 Main, Princeton, Ill.

furnished for service up to 85 C. The 0.001- and 0.005-mf units are paper-dielectric capacitors impregnated with mineral oil; 0.05-mf units are paper-dielectric, wax-impregnated.

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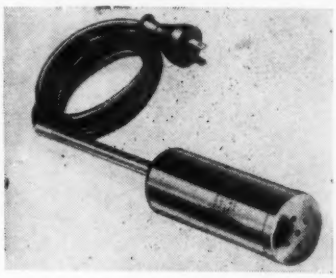
Immersion Water Heater

NEW PORTABLE immersion electric water heater known as the "Shokless" is made available by Kneisley Electric



Co, Toledo, Ohio. The heating element has a copper jacket around it so the water does not come into direct contact with the element. It is said to be safe to use anywhere, as the unit will not plug up with lime or calcium deposits.

The device is stated to provide a fast easy way to heat water around the farm or home for dishes, baths, shaving, washing. The chromium-plated water heater is rated 1,000 w and can be operated from a 115-v a-c or d-c circuit. The nickel alloy heating element is wound on an Alsimag core. Like all immersion heaters, the unit should be completely immersed before being energized.

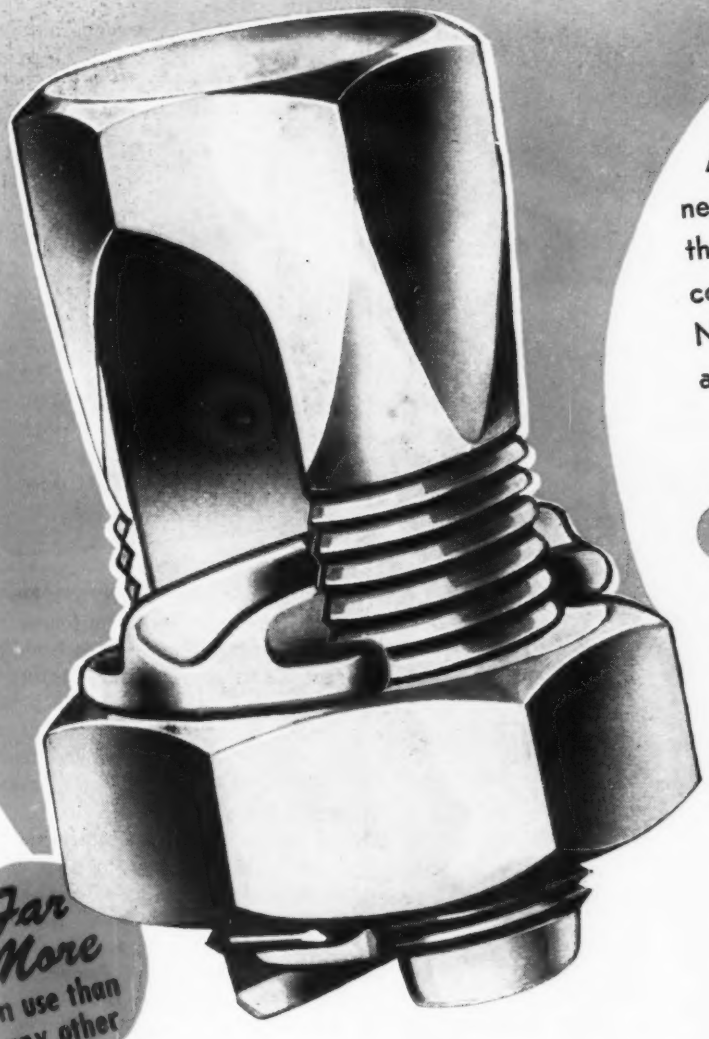
•

Insulation Tester

A NEW INSTRUMENT developed by Radio Frequency Laboratories, Inc, Boonton, N. J., measures insulation resistance of power cables, transformers, condensers, switches and wiring assemblies at any desired d-c voltage up to 10 kv. Breakdown voltages also can be determined. The device consists of a voltage-doubler rectifier power supply providing filtered direct current and two separate circuits for measuring high resistance at the desired test voltage. Full manual control is provided for selecting any output voltage up to the maximum.

Resistances ranging from 0.1 to 50,000 megohms may be read directly on a megohmmeter scale at open circuit voltages of 0.5, 1, 5, and 10 kv, or may be simply calculated in ranges from 0.3 to 20,000 megohms from the readings of a voltmeter and microammeter connected to read resistance at any desired test voltage from 100 volts

PENN-UNION *means* STRENGTH *and* PRECISION



Accurately made, with rigid engineering inspection. The clean smooth threads assure maximum pressure on the conductors — permanently maintained. Not distorted by use . . . re-usable over and over.

BETTER DESIGN

with larger gripping surfaces for the wrenches, from any angle—using either a socket or open-end wrench . . . *more practical to use.* Bevelled slot protects the conductors . . . V-groove assures maximum contact.

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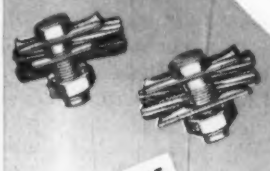
FULL LINE OF ALUMINUM CONNECTORS.



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The COMPLETE Line of Conductor Fittings

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Blaw-Knox Steel Grating has no acute angles, no bolts, nuts or other fastenings to collect dirt or invite corrosion to unprotected surfaces. Its electroforged construction makes it a one-piece steel "material" of exceptional strength, long life and safety underfoot . . . Various weights for various loads.

1. One-piece electroforged steel construction for guaranteed strength!
2. Easy maintenance—paint reaches entire surface!
3. Maximum open area for light and air!
4. Self-cleaning—no sharp corners to clog with dirt!
5. Economical and easy to install—wherever and whatever your grating needs!

See for yourself—Write on your own letterhead for FREE paperweight-size sample.

BLAW-KNOX DIVISION of Blaw-Knox Company
2013 Farmers Bank Bldg., Pittsburgh 22, Pa.

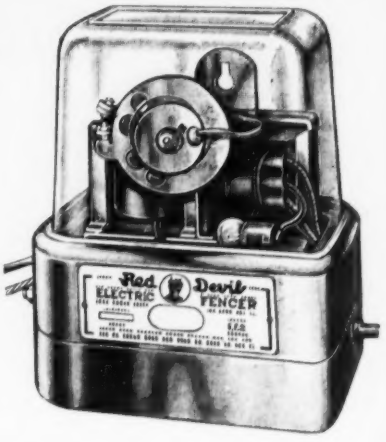
BLAW-KNOX ELECTROFORGED STEEL GRATING

to 10 kv. Either of the alternate methods are selected on one switch. Leakage current ranges are 30, 150, 300 and 1,500 microamperes, readable at any voltage. For polarization checks, a polarity reversing switch allows either the positive or negative side of the voltage supply to be grounded. The tester operates from a 115-volt, 60-cycle circuit and consumes a maximum of 65 watts.

•

Fence Controller

PRODUCTION of a combination battery and highline-current electric fence controller is announced by Red Devil



Tools, Irvington 11, N. J. Known as Model EF 2, the electric fencer has the advantages of operation on highline current. At the same time, battery operation may be had with the same controller, useful when powerline fails or in remote locations where temporary and frequently changing locations are necessary.

The fencer delivers intermittent stinging shocks harmless to man or beast, it is stated. The on-off action is controlled by a new "wheel" type contact, the only moving part. Working parts are sealed against the elements and tampering. For battery operation, any 6-v storage battery may be used.

•

Time-Delay Tube

KNOWN as the Chronotron, a new miniature vacuum tube with time-delay characteristics is a recent development of the Eclipse-Pioneer Division of Bendix Aviation Corp, Teterboro, N. J. It is reported valuable in electronic control circuits when a rate factor and time delay are needed.

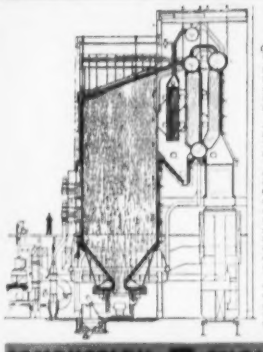
Basic principle of the Chronotron is thermal conductivity, or the flow of heat from one side of an insulator to the other when a differential in tempera-

units for utilities

Recent C-E Steam Generating Units for Utilities

STATION No. 3

ROCHESTER GAS AND ELECTRIC CORPORATION



The C-E Unit, shown at the left, is now under construction in Station No. 3 of the Rochester Gas & Electric Corporation, Rochester, N. Y. It is the latest of six C-E Units installed in this station since 1936.

The unit, largest of the six, is designed for a capacity of 600,000 lb of steam per hr, a pressure of 750 psi and a total steam temperature of 835 F.

It is a 3-drum boiler with extra dry drums followed by separate economizer and air heater. The furnace is completely water cooled using both plain and finned tubes and is equipped with a basket-type bottom discharging to a sluice. The unit is pulverized coal fired employing Type R Horizontal Burners. A large superheater occupies the first pass of the boiler ahead of the convection surface.

Another C-E Unit of 600,000 lb capacity, designed for a pressure of 1475 psi and 955 F steam temperature, has recently been ordered for a new station of the same company.

COMBUSTION ENGINEERING

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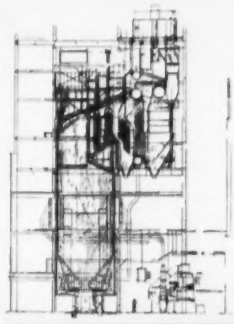
Recent C-E Steam Generating Units for Utilities

CLIFFSIDE STATION

DUKE POWER COMPANY



THE C-E Unit illustrated here is now in process of fabrication for the Cliffside Station of the Duke Power Company, Cliffside, North Carolina. It is one of two such units now on order.

The units are each designed to produce at maximum output 630,000 lb of steam per hr at 1365 psi and a total temperature of 950 F.

They are pulverized coal fired using C-E Raymond Bowl Mills and Vertically Adjustable Tangential Burners. The furnaces are completely water cooled with closely spaced plain tubes, basket bottom type. Each boiler is equipped with a 3-stage superheater. Flown integral economizer in the last pass and a Ljungstrom Air Preheater. Superheat control is by means of Vertically Adjustable Burners and Montaup-type by-pass dampers.

COMBUSTION ENGINEERING

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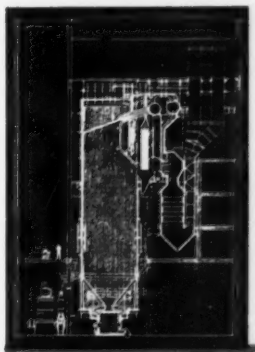
Recent C-E Steam Generating Units for Utilities

B. C. COBB STATION

CONSUMERS POWER COMPANY



The C-E Unit, illustrated here is one of two such units ordered in 1946 for the B. C. Cobb Station of the Consumers Power Company in Muskegon, Michigan. A third unit has recently been ordered.

Each unit is designed to produce at maximum continuous output 600,000 lb of steam per hr at 875 psi and a total temperature of 910 F.

The units are of the 3-drum type with 2-stage superheaters. Furnaces are fully water cooled with closely spaced plain tubes and are of the basket-bottom type. C-E economizers and plate-type air heaters follow the boiler surface.

Pulverized coal firing is used employing C-E Raymond Bowl Mills and Vertically-Adjustable, Tangential Burners. This burner arrangement, in conjunction with Montaup-type by-pass dampers, assures accurate control of superheater temperature.

COMBUSTION ENGINEERING

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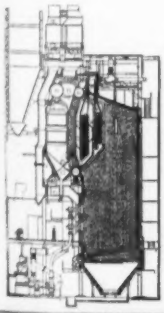
Recent C-E Steam Generating Units for Utilities

MANCHESTER STREET STATION

THE NARRAGANSETT ELECTRIC COMPANY



The C-E Unit, illustrated here, is nearing completion in the Manchester Street Station of The Narragansett Electric Company at Providence, Rhode Island.

It is designed to produce 450,000 lb of steam per hr at a pressure of 1225 psi at superheater outlet and at a temperature of 950 F.

The unit is a 3-drum type boiler with fin tube economizer in the last pass. The superheater is of the 2-stage type with gas flow controlled by a bypass damper. The furnace is completely water cooled using both finned tube and closely spaced plain tube construction. Pulverized coal firing is employed using C-E Raymond Bowl Mills and C-E Horizontal Burners. Burners are arranged to use oil as an alternate fuel. Regenerative air heaters follow the unit.

Another C-E Unit of about this capacity has been giving a good account of itself in this station since 1940, and a duplicate of this unit here described is now on order for future extension to the station.

COMBUSTION ENGINEERING

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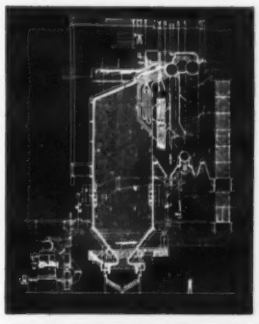
Recent C-E Steam Generating Units for Utilities

MEREDOSIA POWER STATION

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY



The C-E Unit illustrated here, is now under construction in the Meredosia Power Station of the Central Illinois Public Service Company at Meredosia, Illinois.

It is one of four duplicate units for this station designed for a pressure of 950 psi, a total steam temperature of 910 F and a maximum continuous capacity of 285,000 lb of steam per hr.

These units are of the 3-drum type with completely water-cooled, basket bottom furnace. They are pulverized coal fired using C-E Raymond Bowl Mills and Vertically Adjustable, Tangential Burners. The Illinois Superheaters are of the two-stage type. Superheat temperature control is assured by virtue of the vertically-adjustable burners in conjunction with remote manually regulated bypass dampers. C-E Tubular Air Heaters follow the boiler surface.

COMBUSTION ENGINEERING

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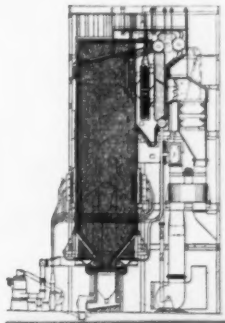
Recent C-E Steam Generating Units for Utilities

O. H. HUTCHINGS STATION

THE DAYTON POWER & LIGHT COMPANY



The C-E Unit illustrated here is one of two such units now in process of fabrication for the O. H. Hutchings Station of The Dayton Power & Light Company at Dayton, Ohio.

The steam/water will be of the Semi-Outdoor Type.

Each unit is designed to produce, at maximum continuous output, 360,000 lb of steam per hr at 1200 psi and a total temperature of 950 F.

The units are of the 3-drum type with 2-stage superheaters. Furnaces are fully water cooled with closely spaced plain tubes and are of the basket-bottom type. C-E Economizers and Ljungstrom Air Heaters follow the boiler surface.

Pulverized coal firing is used employing C-E Raymond Bowl Mills and Vertically-Adjustable, Tangential Burners. This burner arrangement, in conjunction with Montaup-type by-pass dampers, assures accurate control of superheat temperature.

COMBUSTION ENGINEERING

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Combustion Engineering

C-E

200 MADISON AVENUE • NEW YORK 16, N. Y.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS.

Extra SAFETY... *Extra* DURABILITY

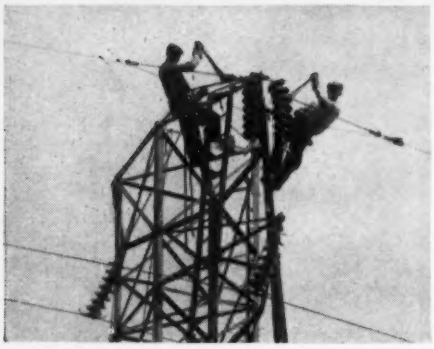
...*Extra*

OPERATING EASE...

WITH

COFFING

SAFETY-PULL HOISTS

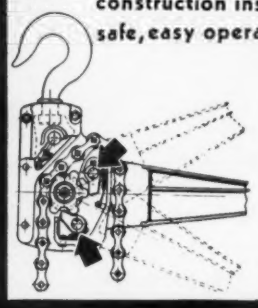


Safety Pull Hoists Used in Changing Insulators

Check these features that give longer hoist life, greater ease of operation—

- Hooks of drop forged heat treated steel
- Reversible handle permits operation in any position
- "Safety Load" handle—bends before other parts will break
- Each model pre-tested to 100% overload
- Coffing exclusive dual ratchet and pawl assembly for maximum safety
- Nine models in capacities from ¼ to 15 tons

Sturdy, simple pawl construction insures safe, easy operation.



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PASEO DE LA REFORMA NO. 1
MEXICO D. F.

IN CENTRAL AMERICA
WELSBACH INTERNATIONAL INC.
APARTADOS 21
SAN JOSE, COSTA RICO

ture exists. The time required for the heat to penetrate the insulator provides the time delay of the tube output signal. Time constants of the Chronotron range from 10 sec to 2 min, depending on the insulating substance used.

The new tube is reported to be unaffected by large variations in ambient temperature and humidity, and its small size offers space and weight advantages.

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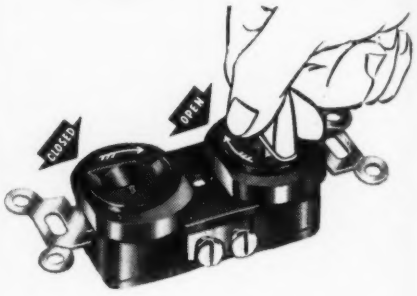
Twin Receptacle

A NEW TWIN convenience outlet made by Bell Electric Co, 1844 West 21st St, Chicago 8, Ill., is said to be foolproof



and to prevent accidents to children or careless adults through electric shock. It is designed to prohibit wires, hairpins, scissors or other foreign objects from being inserted in receptacle slots.

To connect an appliance, insert the plug into slots of rotary cap on face of receptacle, give plug a quarter turn to the right, and push in plug. With its positive spring action, rotary dial cap snaps shut when plug is withdrawn.

This No-Shock receptacle has Bakelite walls separating and insulating heavy duty terminals. It is furnished in either brown or ivory.

•

Oscillograph Tubes

THREE NEW cathode-ray tubes for oscillographic applications have been made available by Radio Corp of America, Harrison, N. J. In all three tubes anode No. 1 is said to draw no appreciable current and so a low-current, voltage-divider system and small filter capacitor can be used. Also the balanced deflecting-electrode input capacitances eliminate the necessity of neutralizing circuits.

Type 3JP7 is a 3-in. tube and has a two-layer phosphor. The greenish-yellow phosphorescence is stated to persist for several minutes under conditions of adequate excitation and low ambient light.

Type 5CP7-A utilizes the long-persistence, two-layer phosphor P7 and

supplements the previously available 5CP1-A.

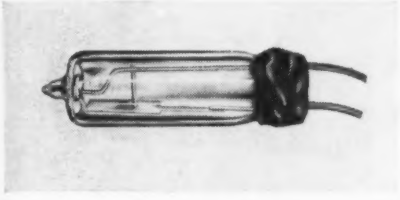
Type 5CP11-A has blue radiation which is stated to be much brighter to the eye than the radiation from older screens. The P11 screen has sufficiently short persistence for all photographic applications except when film is moved at high speed.

•

Magnetic Mercury Switch

A MAGNETIC mercury switch containing only one moving part, and unaffected by dust, dirt or corrosion, has been developed by research engineers of the Minneapolis-Honeywell Regulator Co, Minneapolis, Minn. The new switch may be installed in a fixed vertical position in a space no larger than an average lipstick container.

The instrument is operated by a

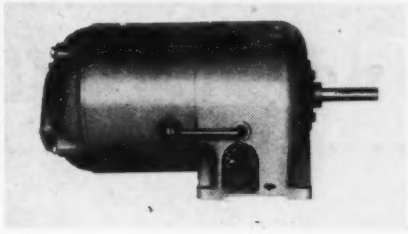


magnetic field through the glass container of the switch. Magnetic attraction pulls one electrode of the switch out of the pool of mercury in the bottom of the device and thus breaks the circuit. Or, the switch may be operated in reverse order so that magnetic attraction moves the electrode into the mercury and closes the switch. The moving electrode is made of spring steel and, thus, contains no complicated hinge mechanism.

The magnetic switch may be operated by moving a small permanent magnet adjacent to the glass wall of the tube or by passing a small current through an electromagnet located adjacent to the tube. Since no flexing of electrical leads or change in center of gravity of the switch is involved, only minimum power is required to operate the new instrument.

The many uses for the new device include applications as a float switch in the measurement and control of liquid levels; in phonographs, coin-operated mechanisms, and weighing machines. It also may be used as a vibrator with a small electromagnet, as an armature and contact assembly for small sensitive relays, and as a sensitive magnetic field detector to operate as a safety switch. This new switch also can be used whenever a mechanical connection between an actuating mechanism and a switch is difficult or impossible, such as in a float control.

Gearshift Drive



AVAILABILITY of a 4-speed gearshift drive, with integrally mounted single-phase motor, is announced by Lima Electric Motor Co, 2301 Findlay Road, Lima, Ohio. The new type R units are built to drive machinery requiring selective speeds and are available in sizes of ½ hp at 1,200 rpm and ¾ hp at 1,800 rpm. Gear ratios of the type R are 1:1, 1.33: 1, 2:1 and 4:1.

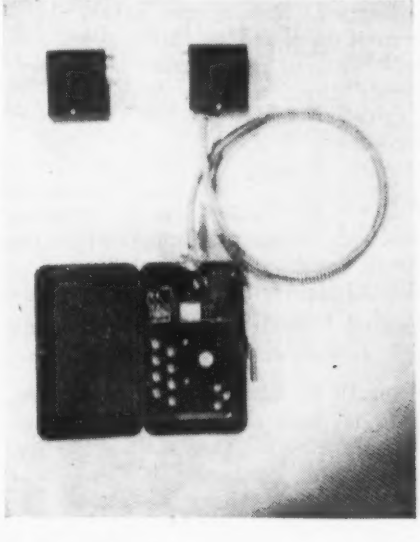
The new single-phase units will operate on 115 and 230 v a-c, 50 and 60 cycle. Mechanically the single-phase and polyphase units are identical.

•

Photoelectric Control

A PHOTOELECTRIC control relay which operates in 1/20 sec has been introduced by Photoswitch Inc, 77 Broadway, Cambridge 42, Mass. This type 20DJ-1 has been designed for automatic control of industrial processes. The phototube and light source lamp are in small dust-tight, die-cast housings wired to the control housing, which is deep-drawn sheet steel.

Operating range is stated to be 10 ft. A sensitivity adjustment on the control housing provides for relay operation at any predetermined illumination level within the range of 10 to 50 ft-c. The control operates on 115 and 230-v, 50/60-cycle circuits. The dpdt relay has a capacity for ½ hp 115/230 v, 10 amp 115 v a-c, 5 amp 230 v a-c.



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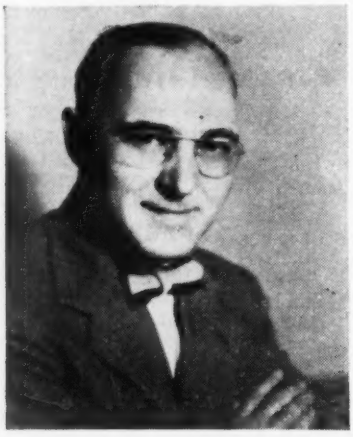
NEWS ABOUT PEOPLE

W. A. Buchanan Joins Staff of Burns and Roe, Inc

Announcement has been made of the appointment of Walter A. Buchanan to the staff of Burns and Roe, Inc, New



W. A. BUCHANAN

York, in the capacity of vice-president.

Mr Buchanan brings to his new executive position a broad background of operating and managerial experience in the utility industry. He entered the public utility field with the Kentucky and West Virginia Power Co at Sprigg, W. Va., in 1920. His work as meter engineer, superintendent and assistant district manager covered all phases of construction, operation, maintenance, rates, accounting and management of a small electric utility. From 1922-26 he served as assistant managing director of the company in Logan, W. Va.

In 1926 the American Gas & Electric Co, parent of the Kentucky and West Virginia utility, purchased control of the American Railways Co, and the West Virginia properties of the latter, added to those already owned, were incorporated into the Appalachian Electric Power Co system. Mr Buchanan was made general superintendent. In this capacity he engaged in the construction, operation and maintenance of the electric generating and distribution system serving a highly diversified industrial area. In 1929 he went to Welch, W. Va., for the Appalachian system as district manager.

Subsequently he served as general manager of the Island Creek Fuel & Transportation Co, at Huntington, and more recently as managing director of the Huntington Chamber of Commerce.

Mr Buchanan has been active in the Edison Electric Institute, and its predecessor, the National Electric Light Association, serving as chairman of the accident prevention committee from 1929 to 1935. He assisted in organizing the West Virginia branch chapter of the American Institute of Electrical Engineers.

•

Loock Elected President of Allen-Bradley Co

At a recent meeting of the board of directors, Fred F. Loock, formerly vice-president and general manager, was

F. F. LOOCK

elected president of the Allen-Bradley Co, Milwaukee, Wis.

Harry L. Bradley was named chairman of the board, in which capacity he will continue to be active in the corporate direction of the company.

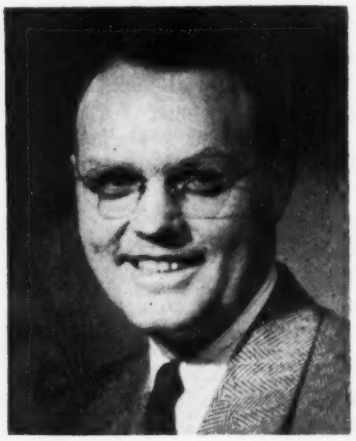
•

► DAVID D. BARBER, JR, Wilmington, has been named chief engineer for the North Carolina State Rural Electrification Administration, succeeding the late J. M. Grainger.

► ADRIAN C. FLETCHER, of Greensboro, Fla., has been elected president of the Talquin Electric Cooperative, Quincy, Fla. J. M. PARKER, Tallahassee, was elected vice-president.

C. W. Stone Made Manager of Intermountain Group

Carlos W. Stone, director of sales and public relations for the Provo, Utah, department of utilities for the past



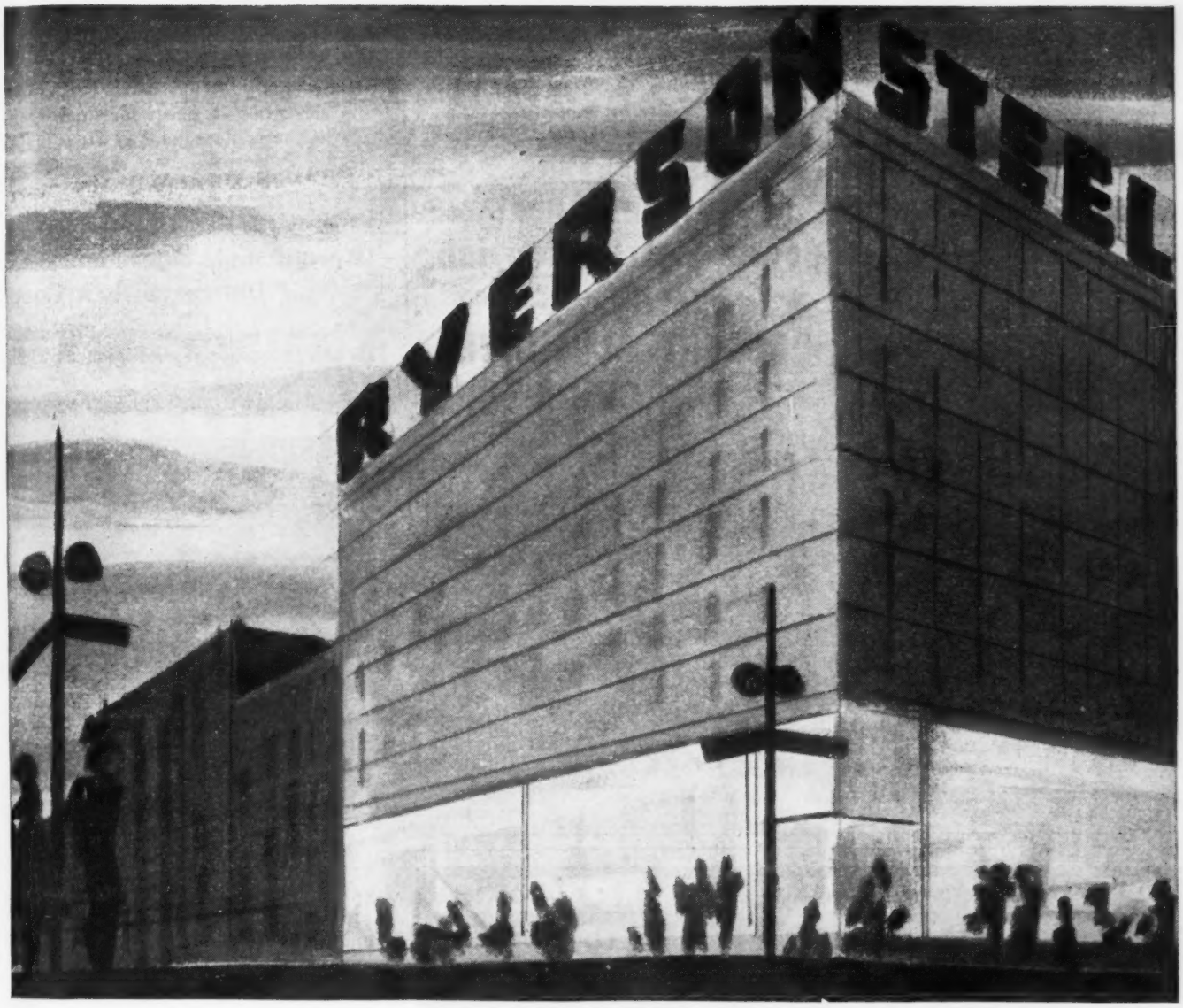
C. W. STONE

three years, is the new manager of the Intermountain Electrical Association. Mr Stone succeeds Arthur J. Reynolds, manager for the past year and a half, who resigned to become sales representative for Westinghouse Electric Supply Co.

The new manager is a native of Sugar City, Idaho. After attending University of Idaho and Brigham Young University, he became a building contractor at Pocatello. For two and a half years before his connection with the Provo city utilities department he was connected with the Geneva Steel Co near Provo.

•

► J. A. TYVAND, formerly chief electrical engineer for the consulting firm of Parsons, Brinckerhoff, Hogan and McDonald of New York, has joined the Otter Tail Power Co, Fergus Falls, Minn., as system planning engineer. Mr Tyvand obtained his early experience with the Milwaukee Electric Railway & Light Co, the Chicago, Milwaukee & St. Paul Railway and with the Public Service Co of Northern Illinois. Subsequently he was transferred to the affiliated Wisconsin Gas & Electric Co as system engineer. Later he joined the Iowa Farm Bureau Federation to lay out and design REA lines. In 1937 he rejoined Wisconsin



The Department Store Idea

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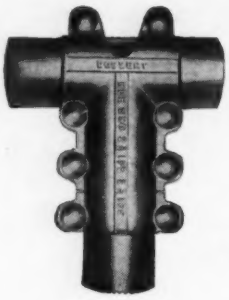
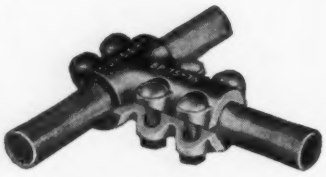


TYPE BPEA



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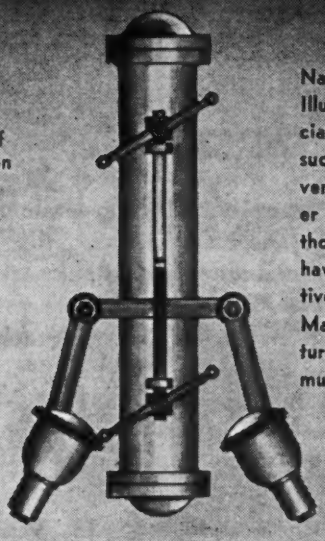

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Gas & Electric as electrical engineer, later being promoted to chief engineer. It was in 1945 that he joined Parsons, Brinckerhoff, Hogan and McDonald. As consulting engineer for this organization he made numerous trips to foreign countries.

•

Huston Made Sales Manager of Unimax Switch Corp

Appointment of William B. Huston as sales manager of the Unimax Switch Corp, New York, has been announced.

Mr Huston's varied and extensive ex-

W. B. Huston

perience in the marketing of electrical products will be utilized in extending and in coordinating the national and export marketing of the company's products.

•

►H. H. Remine, formerly superintendent, electrical distribution department, Quebec Hydro-Electric Commission, Montreal, has been appointed assistant chief engineer of the operating division. L. H. Marrotte, formerly assistant superintendent of city stations for the commission, has been appointed superintending engineer of substations.

►G. L. Pierson, formerly engineering assistant of the Marion division of the Ohio Public Service Co, has assumed the duties of distribution superintendent in the company's Elyria division. Mr Pierson has a background of more than 20 years in electrification work. While a college student and following graduation, Mr. Pierson engaged in sales promotion and rural extension work for the old Suburban Light & Power Co. In 1929 he transferred to the Columbus, Delaware and Marion Electric Co in Marion as rural extension agent, and when that company merged

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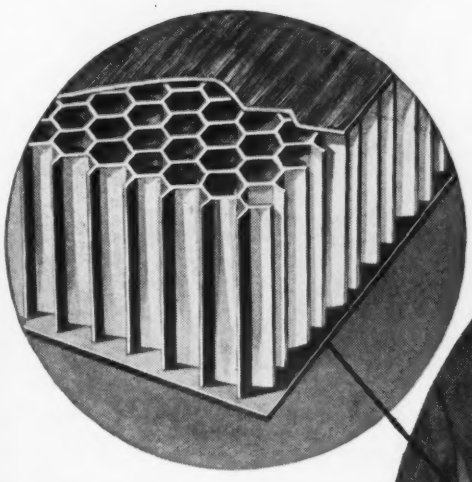

"Honeycomb" plastic panel fabricated by U. S. Plywood Corporation.

"DAISY," the elephant, planted all four feet on this 37-pound panel of "honeycomb" laminate structure impregnated with BAKELITE phenolic resin—and her full weight, tons of it, pressed down upon the unsupported span without detrimental effect. The panel was constructed from a cloth-base core surfaced with paper-base laminated phenolic sheet.

Thus "Daisy" confirmed, in her unscientific but convincing way, the exhaustive laboratory tests to which this material has been subjected. As a matter of fact, this "honeycomb" panel, 4′ x 3′ x 3¼", offered "Daisy" a wide margin of safety. It could hold 25,000 pounds at mid-span without failure.

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The structure can be built of paper, cloth, or glass cloth core, impregnated with BAKELITE phenolic resin, sandwiched between sheets of plywood, aluminum, plastic laminates, or other material. It is highly resistant to moisture, "weathering" and age. It may be had in a range of dimensions up to 5′ x 10′ panels with cores varying from ¼" to 3" or more in thickness. Certain constructions can be sawed like wood.

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with the Marion-Reserve Power Co, he was promoted to assistant superintendent of distribution in 1940. Following the merger of the Marion-Reserve Power Co and the Ohio Public Service Co he was appointed engineering assistant, which position he held until his recent promotion.

•

Lewis Retires; Completes 39 Years' Service in Spokane

Lewis A. Lewis, division manager of the Washington Water Power Co at Spokane, Wash., and assistant general manager of the company, has retired after 39 years with the company, during which time he actively participated in bringing about the development and widespread use of electric power.

Mr Lewis started with Washington Water Power as a mechanic at the Ross Park steam plant in 1906 and soon thereafter was transferred to the sales department when the company launched a porch-street-lighting campaign.

From 1923 to 1946 Mr Lewis headed the national electric range survey committee, comprised of electric range experts from Spokane, Seattle, Wash., and Boise, Idaho. A report published by Mr Lewis, with special attention directed to power distributors, became the genesis of the electric range industry.

In 1910, Mr Lewis became a member of the National Electric Light Association and in 1925 was elected its president. He was appointed assistant general manager of Washington Water Power's Spokane office in 1929 and to the board of directors in 1934. He was named Spokane division manager in 1939.

OBITUARY

▶ BENJAMIN R. FOOTE, 61, research engineer for the Hartford Electric Light Co, since 1936, died at West Hartford on August 27. He was a graduate of Sheffield Scientific School, Yale University. From 1907 to 1916 he was a design engineer with General Electric, Schenectady. He then entered the Hartford company's engineering department. Mr Foote was widely known for his rate research, cyclical trend studies and circuit calculations.

▶ NELSON F. MELLEN, 59, for 25 years a member of the sales staff of the Narragansett Electric Co, Providence, R. I., died on August 25.

▶ FRITZ ZIEBARTH, 52, of Long Beach, Calif., died on August 29 at his Palm-

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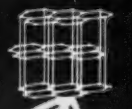

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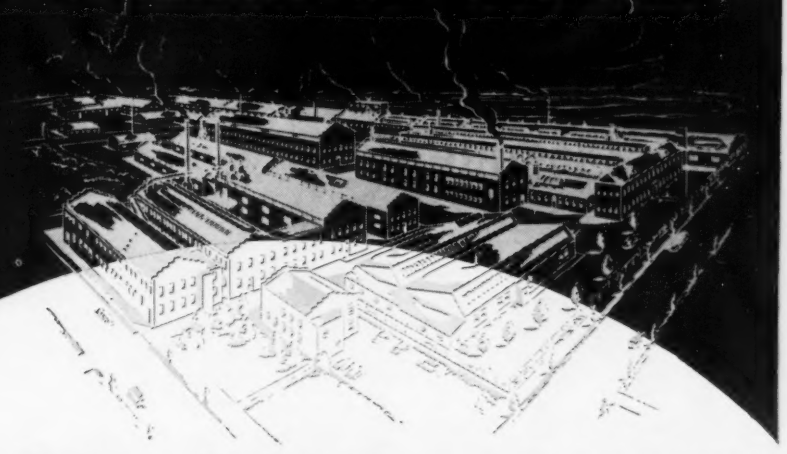

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dale ranch as the result of the heart attack. He was contractor for major electrical installations at Hoover and Shasta Dams and also built power lines from Parker Dam to Arizona and California, power stations in the Imperial Valley and rural electrification projects in the Pacific Northwest.

▶ CLINTON N. RACKLIFFE, assistant to the vice-president of the Carolina Power & Light Co, Raleigh, N. C., died in that city on September 1 after a short illness. He was 69 years old. Mr Rackliffe had been connected with the utility properties in Raleigh for 35 years. He was industrial sales manager for many years and negotiated the contracts in most of the towns the company now serves. A native of Easton, Me., he was graduated in electrical engineering from the University of Maine in 1902.

▶ MAURICE J. WOHL, manufacturer and inventor of electric lighting equipment and household commodities in the New York area, died on September 2 after a brief illness at his home in Brooklyn. He was 68 years old. Mr Wohl was a pioneer in the application of the arc-lamp for street lighting and therapeutic purposes. In other electrical fields he developed starters for marine engines and electric refrigeration.

▶ JAMES R. BEATTY, employee of the Houston Lighting & Power Co, Houston, Tex., for the past 51 years, died at his home in that city on September 3. He was 76 years old. Mr Beatty, who started as a groundman for the light company in 1896, was honored by the company in 1940 when the Beatty substation of the company in Bellaire was named for him. For many years, Mr Beatty was general foreman in the distribution department. He had been inactive for some time. Mr Beatty was a native of Mercersburg, Pa.

▶ PERRY MCCART, of Paoli, Ind., retired lawyer and former chairman of the Indiana Public Service Commission, died on September 3 at the age of 83. Mr McCart was a native of Paoli and a graduate of the University of Tennessee.

▶ RALPH F. STRICKLAND, member of the engineering staff at the General Electric Lamp Department, Nela Park, Cleveland, Ohio, for 32 years, died in Jacksonville, Fla., on September 13. He was 64 years old. After graduation from Case School of Applied Science in 1908, Mr Strickland worked for Euclid Lamp Works, which later became a part of Nela Park. He spent many years in experimental work in lamp development and retired from active service a year ago.

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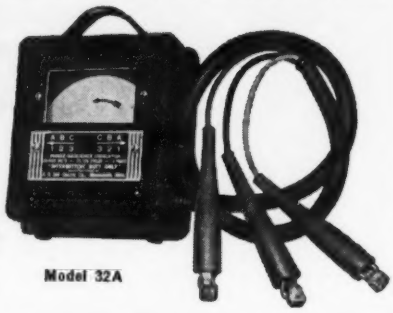

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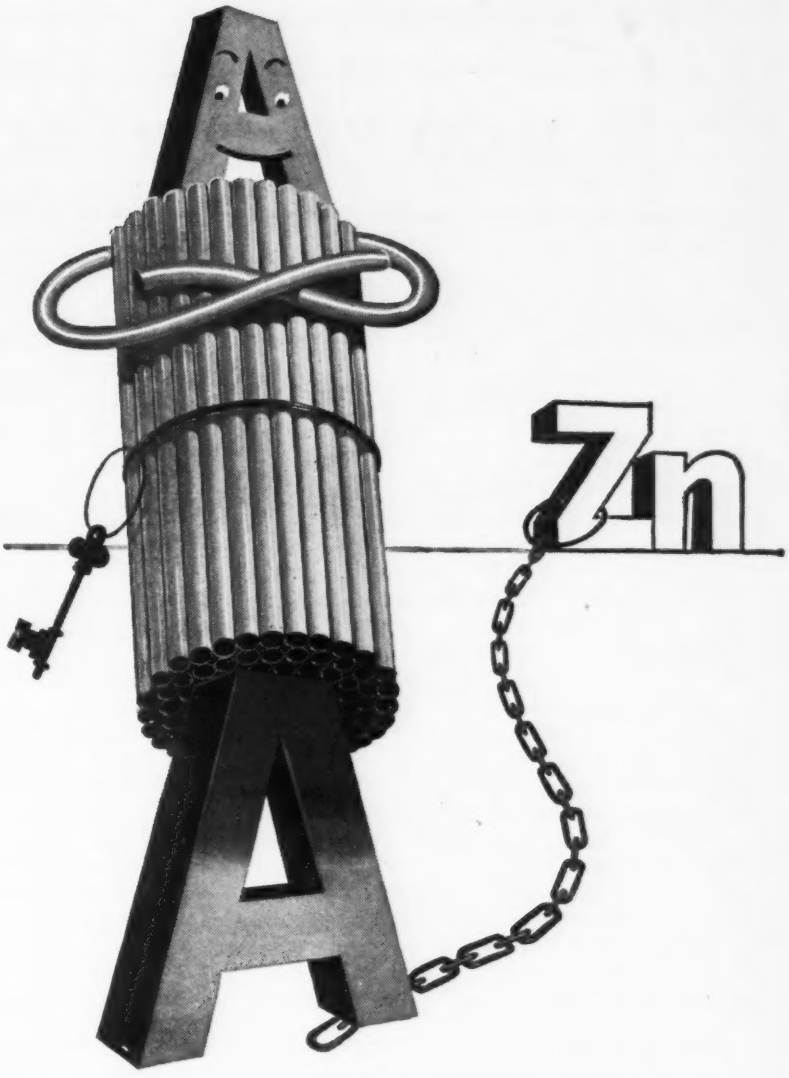

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MANUFACTURERS & MARKETS

Steel Alloy Ingots Cast by New Process Will Supply Stronger Disks for Turbines

A new process for continuous casting of steel alloy ingots offers stronger and more ductile materials for high-temperature service. H. R. Austin, president of the M. W. Kellogg Co. described the process as an "electric ingot method for continuous metal casting."

Alloying elements are fed continuously at a controlled rate into an electrical apparatus. Air is excluded. The ingot solidifies progressively with uniform chemical analysis and physical properties. The casting forms in the same container in which raw materials are melted. Uniformity results, not only through the ingot, but from ingot to ingot. "Pipe," or central cavity, has been entirely eliminated along with internal bursts and segregated carbides.

During the war hundreds of tons of high-speed tool steel were made by this process. Tools were used in both cast and rolled conditions. Those made directly from the cast metal functioned as well as forged tools of the same analysis.

First major application of post-war commercial significance is expected to be for gas-turbine disks. Research aims at producing alloys by this process good for 1,500 F and higher. Absence of "pipe" at the center of the ingot contributes to greater strength and ductility at the turbine wheel's highly stressed center portion. Metal can have either higher strength for same ductility or higher ductility for same strength.

Process can also, for example, produce an ingot of higher-strength carbon steel within an outer shell of high-temperature alloy. From such an ingot, a turbine disk can be made with very strong hub and temperature resisting rim, an effect otherwise unobtainable except by welding.

No limit is seen to size of ingot that can be produced. Present ones range from 6 in. to 6 ft. Research heats as small as 25 to 50 lb are practical in the same equipment used for commercial volume production. Single-ingot producers are now running at top capacity. A multiple-ingot production unit will start up in Jersey City early in 1948. Cost of superior alloys produced by this process are expected to be not greater than ones of the same analysis now command.

The Kellogg Co plans to continue manufacturing special alloy steels itself. It also has a cooperative program for development of new alloys with other industrial and government agencies. This metallurgical research is aimed at production of other alloys with still better properties.

MISS VIVIEN KELLEMS, president of Kellems Co, checks an installation of her company's cable grips on the Hawaiian Electric Co system in Honolulu. With her are E. V. Schoenberg, left, superintendent of underground, and F. K. Bartels, superintendent of overhead for the utility. The grip under Miss Kellem's hand holds a 750,000-cir mil, 11-kv cable. Cylindrical objects at left are 1,500-lb springs that hold cable tension constant at all times

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GE Fractional Hp Motor Output Sets Record High

Production of fractional hp motors has been boosted to a record high at General Electric through a standardized program coupled with increased manufacturing facilities. But supply has not yet caught up with demand for certain types, according to A. W. Bartling, manager of the company's fractional horsepower division.

Even though output this year will be "considerably above" the average rate for the pre-war years. 1936-1940, motors for washing machine, fans, blowers, sump pumps and similar applications are still in short supply. Mr Bartling said. These are constant-speed alternating-current motors rated from 1/6 to 1/3 hp.

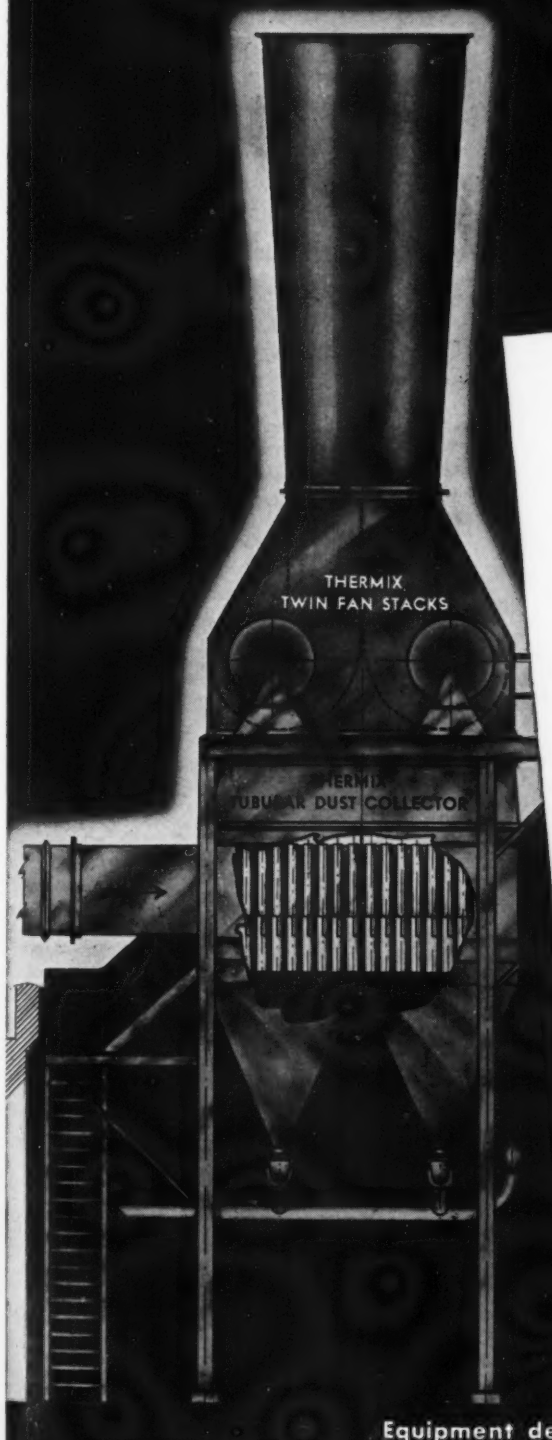
Mr Bartling attributed a considerable share of his company's over-all gains in small motor production to an industry-wide fractional hp motor standardization program, on which the General Electric organization has cooperated with NEMA.

"Through this program, we have re-

The Atlas Powder Company

STAMFORD, CONNECTICUT PLANT

solved its summer-winter peak loads with THERMIX Induced Draft and Dust Collecting Equipment



At this plant there are 4 boilers. The winter peak is 120,000 lbs. of steam per hour from 2 or more boilers. In the summer, the peak is 60,000 lbs. of steam per hour from 1 or more boilers.

Space was at a premium because of adjoining building walls and the Draft and Dust Collector Equipment had to be placed in operation without any cessation of service of the steam plant.

To answer the summer-winter peak load problem, a Thermix twin fan (Type 1-A) stack was installed directly above a Thermix Tubular Dust Collector divided into two cells, each of which served a fan. Both fans were adequate for the winter peak load while one fan and one Collector section easily carried the summer peak load.

It was necessary to install and place the unit in operation without interruption of steam flow. The gas was temporarily allowed to continue its original flow through an existing brick stack while the new equipment was being installed and placed in service. This was accomplished with no interruption.

Problems such as this are often solved by the use of Thermix Equipment. This solution was engineered and designed by The Thermix Corporation project engineers and they will be glad to aid you in your search for more efficient draft producing methods.

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duced the number of different kinds of motors being manufactured at one time from more than 25,000 to less than 4,000," Mr Bartling said.

•

Sees Continued Shortage of Technical Manpower

Companies are short of technically trained men today, and competition for these men is keener than it ever was, according to H. N. Muller, manager of the educational department for the Westinghouse Electric Corp. Engineering colleges report a 100 percent increase in the number of companies now interviewing their graduates in comparison to pre-war years.

This latest manpower shortage, Mr Muller predicted, will last well into 1949 or 1950. It stems directly from industrial expansion, coupled with the relatively few engineers and scientists graduated from colleges during the war. Westinghouse alone is now recruiting from the colleges over 100 more men each year than during pre-war years.

Starting pay for college graduates is far above pre-war levels, Mr Muller explained. Veterans of World War II are given additional consideration and start at rates even above the new high scale for non-veterans.

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Proctor Electric Amplifies Its Merchandising Policy

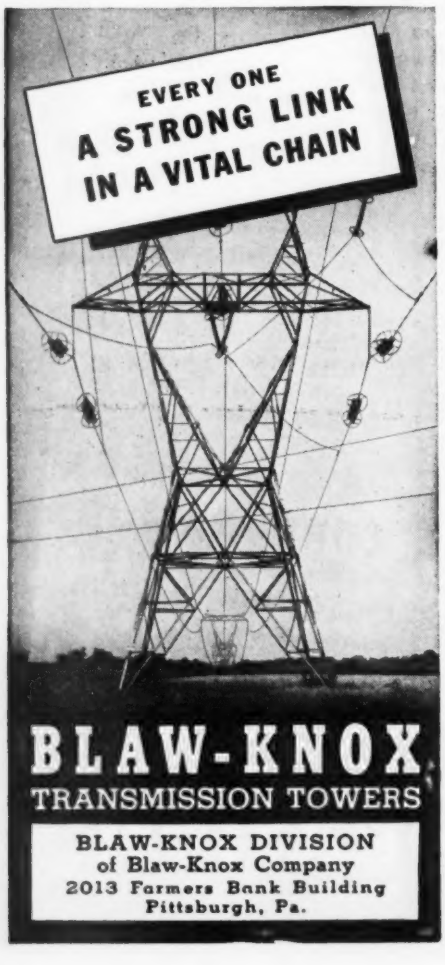
Amplification of Proctor Electric Co's merchandising policy to include price protection in the event of a downward price revision has been announced by Robert M. Oliver, vice-president in charge of sales.

Previously, the company gave distributors, through whom it distributes its products exclusively, advance notice of model changes to permit an orderly disposal of inventories. This policy has now been extended to include price reductions and is further defined to expressly mean a minimum of 60 days advance notice.

•

Cabl-Ox Corp Organized

Announcement has been made of the formation of Cabl-Ox Corp with headquarters at 6 North Michigan Ave, Chicago. The new firm has purchased the entire and exclusive rights to the Cabl-Ox Wire rope clamp, Cabl-vise and allied wire rope products which it will manufacture and merchandise on an enlarged plan. Peak production is expected by the first of the year. New literature is available at the Chicago headquarters.



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